SOIL SURVEY OF

Hutchinson County, Texas

United States Department of Agriculture
Soil Conservation Service

In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1968-71. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Hutchinson Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Hutchinson County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites.

Game managers and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitabilities for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice sites for nonindustrial buildings and for recreation areas in the section "Engineering Interpretations of Soils."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Hutchinson County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Contents

Issued November 1976

SOIL SURVEY OF HUTCHINSON COUNTY, TEXAS

BY BILLY R. STRINGER, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY BILLY R. STRINGER AND JACK C. WILLIAMS,
SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

HUTCHINSON COUNTY is in the north-central Panhandle. It covers an area of 911 square miles, or 583,040 acres (fig. 1).

Stinnett, the county seat, is at the intersection of Texas Highways 152, 136, and 207. Borger, the largest city in the county, is the center of a vast oil- and gas-producing area. The complex of petroleum and petrochemical plants in the Borger area is the largest in Texas, except for the Gulf Coast. Ranching, wheat farming, and recreation activities bring additional income to the county. Borger, Fritch, and Stinnett are the gateways to Lake Meredith, the principal sports area in the Panhandle. Lake Meredith supplements the water supply of the 11 member cities of the Canadian River Municipal Water Authority, which includes Borger. About 74 percent of Hutchinson County is used for range. The average annual rainfall is 20.7 inches, and the average temperature is 58°F. The elevation ranges from 2,750 to 3,400 feet above sea level.

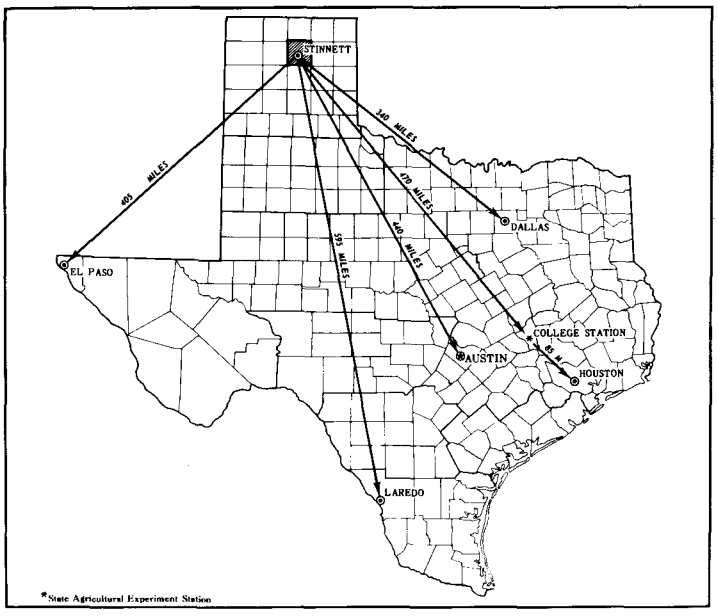


Figure 1.—Location of Hutchinson County in Texas.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Hutchinson County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for differences in texture of the surface layer, all soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Sherm and Likes, for example, are the names of two soil series. All the soils in the United States having the same series names are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of

such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Sherm clay loam, 0 to 1 percent slopes, is one of two phases within the Sherm series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Hutchinson County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils joined by a hyphen. Dallam-Urban land complex, 0 to 3 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Berda-Potter-Caliche outcrop association, steep, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Berda and Mansker soils, 5 to 8 percent slopes, is an undifferentiated group in this county.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Urban land is a land type in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how the soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Hutchinson County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or other structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Hutchinson County are discussed in the following pages.

1. *Likes-Tivoli-Lincoln association*

Nearly level to sloping and rolling, noncalcareous or calcareous sandy soils that are moderately rapidly permeable or rapidly permeable

This association is mainly nearly level to rolling sandy soils along the Canadian River and its tributar-

ies. It makes up about 28 percent of the county. About 41 percent of the association is Likes soils, 18 percent is Tivoli soils, and 15 percent is Lincoln soils. The remaining 26 percent is Dallam, Mobeetie, Yahola, Veal, Sweetwater, Berda, Obaro, Tascosa, and Burson soils and river and water channels.

Likes soils have a surface layer of brown calcareous loamy fine sand about 6 inches thick. The next layer is pale-brown calcareous loamy fine sand about 28 inches thick. The underlying material is very pale brown, calcareous loamy fine sand to a depth of 80 inches.

Tivoli soils have a surface layer of brown noncalcareous fine sand about 4 inches thick. The next layer is very pale brown noncalcareous fine sand about 48 inches thick. The underlying layer is light-brown calcareous fine sand to a depth of 84 inches.

Lincoln soils have a surface layer of grayish-brown calcareous loamy fine sand about 14 inches thick. The underlying material is light yellowish-brown loamy fine sand 49 inches thick. Flooding occurs on these soils 1 to 3 times a year for 1 to 5 hours. The water table is at a depth of 3 to 5 feet.

Likes soils are mostly gently sloping to sloping and are in areas below Tivoli soils and above Lincoln soils. Tivoli soils are gently sloping and rolling and are in areas above Likes and Tivoli soils. Lincoln soils are mostly nearly level, and the surface layer is slightly hummocky. They are in areas below Likes and Tivoli soils.

This association is used mainly for range.

2. *Sherm-Gruver association*

Nearly level to gently sloping, noncalcareous loamy soils that are very slowly permeable to moderately slowly permeable

This association is in smooth areas. No definite drainage pattern is evident, but the association slopes slightly to the playas. The association makes up about 21 percent of the county. About 86 percent of the association is Sherm soils, and 7 percent is Gruver soils. The remaining 7 percent is Sunray, Conlen, Dumas, Potter, and Ness soils (fig. 2).

Sherm soils have a surface layer of brown, neutral clay loam about 6 inches thick. The next layer is brown clay about 14 inches thick. The next layer is clay loam to a depth of 80 inches. In the upper 16 inches this layer is brown, in the 16 inches below that it is light brown, and in the next 18 inches it is pink. In the lowermost 10 inches it is reddish yellow, and 12 percent of it is calcium carbonate.

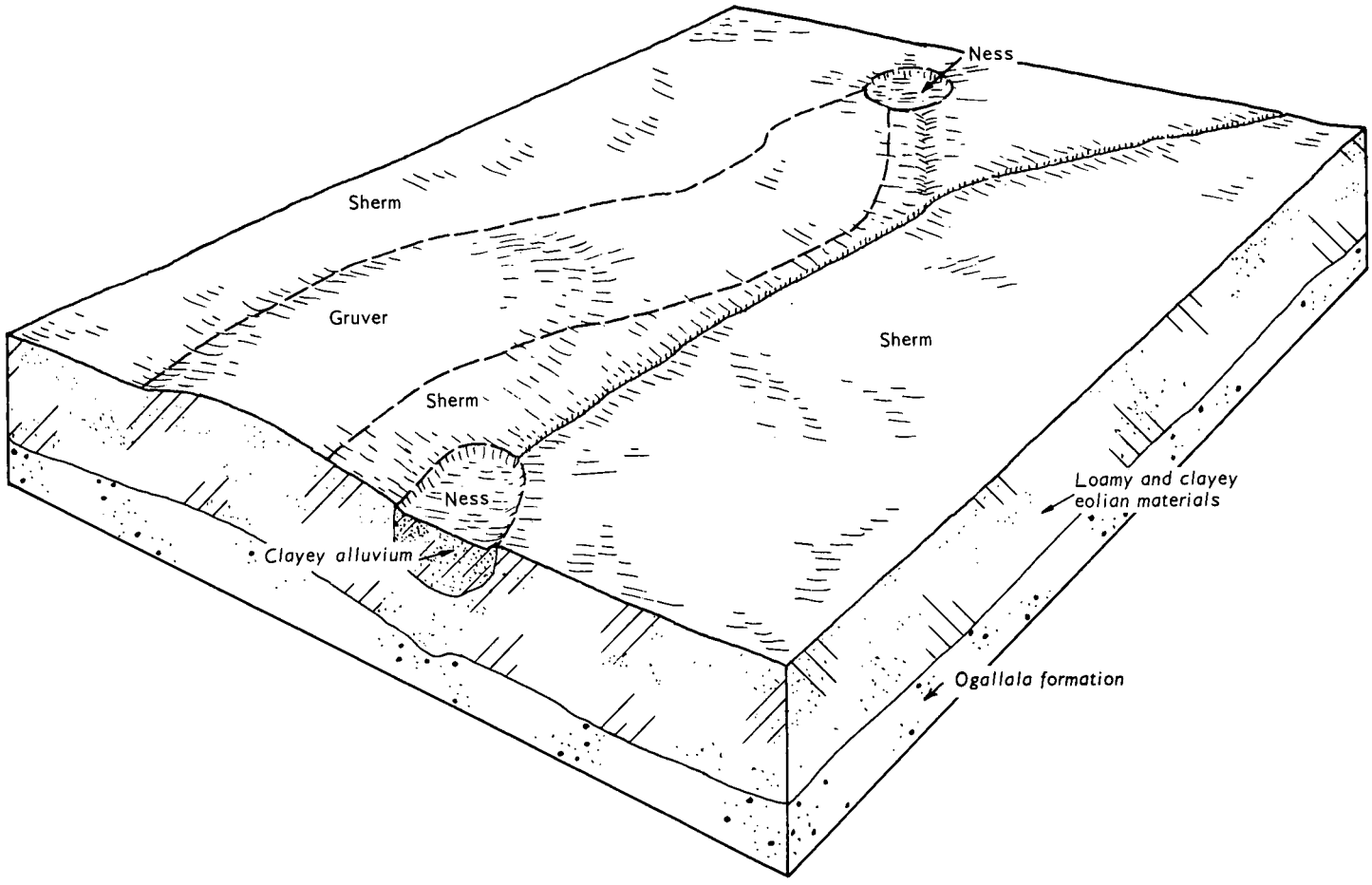


***Figure 2.*—Parent material and position of soils in association 2.**

Gruver soils have a surface layer of brown, neutral clay loam about 7 inches thick. The next layer is clay loam 73 inches thick. In the upper 17 inches this layer is brown, in the 24 inches below that it is light brown, and in the next 18 inches it is pink. In the lowermost 14 inches it is reddish yellow.

Sherm soils are in large, smooth areas slightly below Gruver soils. Gruver soils are on slightly convex ridges slightly above Sherm soils.

This association is used mainly for dryfarming and irrigated farming. The soils are well suited to surface irrigation, because they are smooth. Small areas are used for range.

3. *Mobeetie-Berda-Veal association*

Gently sloping to steep, calcareous loamy soils that are moderately rapidly permeable to moderately permeable

This association is deep soils along deeply cut drainageways. It makes up about 20 percent of the county. About 36 percent of the association is Mobeetie soils, 20 percent is Berda soils, and 15 percent is Veal soils. The remaining 29 percent is Humbarger, Sunray, Obaro, Dallam, Likes, Tivoli, Lincoln, Conlen, Dumas, Potter, and Tascosa soils and Caliche outcrop.

Mobeetie soils have a surface layer of grayish-brown calcareous fine sandy loam about 8 inches thick. The next layer is calcareous fine sandy loam 72 inches thick. In the upper 17 inches this layer is light brownish gray, and in the next 17 inches it is pale brown. In the lowermost 38 inches it is light yellowish brown.

Berda soils have a surface layer of grayish-brown calcareous loam about 8 inches thick. The next layer is loam 72 inches thick. In the upper 18 inches this layer is light brownish gray and calcareous, and in the next 20 inches it is pale brown. In the lowermost 34 inches it is very pale brown.

Veal soils have a surface layer of brown calcareous fine sandy loam about 6 inches thick. The next layer is calcareous sandy clay loam about 60 inches thick. In the upper 9 inches this layer is grayish brown, and in the lower 51 inches it is pink. The underlying material is light-brown, calcareous fine sandy loam to a depth of 80 inches.

Mobeetie soils are on foot slopes below Veal soils and in deeply cut drainageways above flood plains. Berda soils are mainly above drainageways on foot slopes that are below Veal soils. Veal soils are in areas that are slightly above Mobeetie and Berda soils.

This association is used mainly for range, but a few areas are used for crops.

4. *Tascosa-Burson association*

Gently sloping to steep, calcareous loamy to gravelly soils that are moderately permeable

This association is on deeply cut drainageways along the Canadian River and its tributaries. It makes up about 15 percent of the county. About 34 percent of the association is Tascosa soils, and 25 percent is Burson soils. The remaining 41 percent is Obaro, Dallam, Mobeetie, Clairemont, Likes, Tivoli, Lincoln, Veal, Sweetwater, and Quinlan soils and Urban land.

Tascosa soils have a surface layer of brown calcareous gravelly loam about 8 inches thick. The next layer is pinkish-gray calcareous very gravelly loam about 14 inches thick. The underlying material is pink calcareous very gravelly sandy loam to a depth of 60 inches.

Burson soils have a surface layer of yellowish-red calcareous loam about 6 inches thick. The underlying material is reddish-yellow, calcareous, weakly cemented, stratified loam or silty clay loam to a depth of 40 inches. Fragments of limestone cover 40 to 60 percent of the surface layer.

Tascosa soils are in areas slightly above Burson soils. Burson soils are mainly steep.

This association is used for range and as wildlife habitat. It is better suited to wildlife habitat than to most other uses.

5. *Conlen-Sunray-Humbarger association*

Nearly level to gently sloping, calcareous loamy soils that are moderately permeable

This association is mainly on side slopes of drainageways on uplands. It makes up about 9 percent of the county. About 35 percent of the association is Conlen soils, 24 percent is Sunray soils, and 5 percent is Humbarger soils. The remaining 36 percent is Sherm, Gruver, Dumas, Berda, Mobeetie, Veal, Potter, and Ness soils.

Conlen soils have a surface layer of dark grayish-brown calcareous clay loam about 10 inches thick. The next layer is calcareous clay loam 70 inches thick. In the upper 6 inches this layer is light brown, in the next 18 inches it is pinkish white, and below that it is pinkish gray. In the lowermost 20 inches it is reddish yellow.

Sunray soils have a surface layer of dark grayish-brown calcareous clay loam about 10 inches thick. The next layer is clay loam 70 inches thick. In the upper 12 inches this layer is reddish yellow, in the 18 inches below that it is pink, and in the next 26 inches it is reddish yellow. In the lowermost 14 inches it is yellowish red.

Humbarger soils have a surface layer of dark grayish-brown calcareous clay loam about 18 inches thick. The next layer is grayish-brown calcareous clay loam about 22 inches thick. The underlying material is light brownish-gray loam to a depth of 60 inches.

Conlen and Sunray soils are mostly nearly level to gently sloping and are in areas above Humbarger soils. Humbarger soils are mostly in nearly level areas and in concave areas along drains in valley floors.

This association is used for cultivated crops and range.

6. *Dallam-Dumas association*

Nearly level to gently sloping, noncalcareous loamy soils that are moderately permeable

This association is along drainageways of the Canadian River. It makes up about 7 percent of the county. About 70 percent of the association is Dallam soils, and 22 percent is Dumas soils. The remaining 8 percent is Veal and Ness soils and Urban land.

Dallam soils have a surface layer of brown noncalcareous fine sandy loam about 7 inches thick. The next layer is sandy clay loam about 43 inches thick. In the upper 28 inches this layer is brown and noncalcareous, and in the lowermost 15 inches it is light brown and

calcareous. The next layer is reddish-yellow, calcareous fine sandy loam about 20 inches thick. The underlying material is light-brown calcareous fine sandy loam to a depth of 84 inches.

Dumas soils have a surface layer of brown noncalcareous loam about 10 inches thick. The next layer is clay loam 74 inches thick. In the upper 10 inches this layer is dark brown and noncalcareous, in the next 16 inches it is light brown and calcareous, in the 10 inches below that it is pink and calcareous, and for 22 inches it is light brown and calcareous. In the lowermost 16 inches it is brown and calcareous.

Dallam soils are in areas below Dumas soils. Dumas soils are in areas slightly above Dallam soils.

This association is used for crops and range. It is well suited to crops.

Descriptions of the Soils

This section describes the soil series and mapping units in Hutchinson County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit, range site, or other interpretative group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*5*).[1]

Berda Series

The Berda series consists of deep, calcareous loamy soils that are gently sloping to steep. These soils are on foot slopes and alluvial fans in valleys. They formed in calcareous loamy sediment derived from slope alluvium.

[1] Italic numbers in parentheses refer to Literature Cited, p. 49.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Berda loam, 1 to 3 percent slopes	1,140	0.2	Mobeetie fine sandy loam, 3 to 5 percent slopes	9,210	1.6
Berda loam, 3 to 5 percent slopes	5,020	.9	Mobeetie fine sandy loam, 5 to 12 percent slopes	17,640	3.0
Berda-Potter-Caliche outcrop association, steep	16,810	2.9	Mobeetie and Veal soils, 5 to 20 percent slopes	43,870	7.5
Berda and Mansker soils, 5 to 8 percent slopes	7,600	1.3	Ness clay	3,160	.5
Berda and Veal soils, 3 to 15 percent slopes	18,690	3.2	Obaro loam, 1 to 3 percent slopes	2,370	.4
Burson stony loam, steep	22,720	3.9	Obaro loam, 3 to 5 percent slopes	3,420	.6
Clairemont silt loam	540	.1	Obaro-Urban land complex, 3 to 12 percent slopes	2,980	.5
Conlen loam, 0 to 1 percent slopes	1,380	.2	Obaro and Quinlan soils, rolling	13,330	2.3
Conlen loam, 1 to 3 percent slopes	11,020	1.9	Potter soils, 5 to 20 percent slopes	7,200	1.2
Conlen loam, 3 to 5 percent slopes	8,860	1.5	Sherm clay loam, 0 to 1 percent slopes	101,690	17.4
Dallam fine sandy loam, 0 to 1 percent slopes	4,070	.7	Sherm clay loam, 1 to 3 percent slopes	4,320	.7
Dallam fine sandy loam, 1 to 3 percent slopes	20,860	3.6	Sunray clay loam, 0 to 1 percent slopes	5,320	.9
Dallam fine sandy loam, 3 to 5 percent slopes	4,730	.8	Sunray clay loam, 1 to 3 percent slopes	11,370	2.0
Dallam-Urban land complex, 0 to 3 percent slopes	1,730	.3	Sweetwater soils	4,780	.8
Dumas loam, 0 to 1 percent slopes	4,020	.7	Tascosa gravelly loam, 3 to 20 percent slopes	32,930	5.7
Dumas loam, 1 to 3 percent slopes	5,580	1.0	Tivoli fine sand	30,460	5.2
Dumas clay loam, 0 to 1 percent slopes	1,100	.2	Veal fine sandy loam, 1 to 3 percent slopes	3,910	.7
Gruver clay loam, 0 to 1 percent slopes	6,230	1.1	Veal fine sandy loam, 3 to 5 percent slopes	7,780	1.3
Gruver clay loam, 1 to 3 percent slopes	2,870	.5	Veal-Urban land complex, 1 to 5 percent slopes	1,020	.1
Humbarger clay loam	1,320	.2	Yahola fine sandy loam	1,466	.3
Humbarger clay loam, channeled	1,620	.3	Water and river channel	23,104	4.0
Likes loamy fine sand, 1 to 6 percent slopes	75,420	12.9			
Lincoln soils	27,400	4.7	Total	583,040	100.0
Mobeetie fine sandy loam, 1 to 3 percent slopes	980	.2			

In a representative profile the surface layer is grayish-brown loam about 8 inches thick. The next layer is light brownish-gray friable loam about 18 inches thick. Below that, to a depth of 46 inches, is pale-brown loam about 20 inches thick. The underlying material is very pale brown loam to a depth of 80 inches or more.

Berda soils are well drained. Permeability is moderate, and the available water capacity is high. Runoff is medium to rapid.

Most areas of these soils are in range, but a few areas are farmed.

Representative profile of Berda loam, 3 to 5 percent slopes, 4.1 miles north of courthouse in Stinnett on Texas Highway 136, 200 feet east, in a pasture:

A1—0 to 8 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure parting to weak, granular; slightly hard, friable; few fine worm casts; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B2—8 to 26 inches, light brownish-gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak, coarse, prismatic structure parting to moderate, fine, granular; hard, friable; common worm casts; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B2ca—26 to 46 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak, subangular blocky structure; hard, friable; common soft masses and concretions of calcium carbonate, about 5 percent by volume; calcareous; moderately alkaline; diffuse, wavy boundary.

C—46 to 80 inches, very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; massive; hard, friable; few soft masses and concretions of calcium carbonate, about 2 percent by volume; calcareous; moderately alkaline.

The solum ranges from 40 to 52 inches in thickness. The A horizon is grayish brown or brown. It ranges from 6 to 10 inches in thickness. It ranges from loam to clay loam. The B2 horizon is light brownish gray, light brown, or pale brown. It ranges from 10 to 24 inches in thickness. The B2, B2ca, and C horizons are loam, clay loam, or sandy clay loam. The B2ca horizon is pale brown, light brown, or light yellowish brown. Calcium carbonate content in this horizon ranges from 4 to 10 percent by volume. The C horizon is very pale brown, brown, or light brown. Calcium carbonate content in this horizon ranges from 1 to 20 percent.

Berda soils are near the mesic-thermic line, but some have a temperature of less than 59° F and consequently are outside the range described for the Berda series.

Berda loam, 1 to 3 percent slopes (BeB).—This gently sloping soil is in valleys. Areas are long and irregular in shape. They range from 20 acres to about 100 acres in size. The average slope is about 2 percent.

The surface layer is grayish-brown loam about 8 inches thick. The next layer is pale-brown loam about 15 inches thick. Below that, to a depth of 46 inches, is light yellowish-brown loam. The underlying material is very pale brown loam to a depth of 80 inches.

Included with this soil in mapping are Veal and Mobeetie soils and Berda loam, 3 to 5 percent slopes. Also included are small areas of soils that are similar to this soil, but the surface layer is dark colored. These areas are at the edges of mapped areas. A few rills or gullies as much as 3 feet deep are included in some areas.

This soil is used mainly for range. The main crops grown are wheat and grain sorghum.

The hazard of erosion is moderate. Keeping crop residue on the surface and using residue-conserving tillage, contour farming, and terracing help control erosion and also maintain good tilth. Diversion terraces and grassed waterways are needed in places. Irrigated crops respond to fertilizer. Limited tillage and keeping crop residue on the surface reduce erosion. A sprinkler system of irrigation is best suited to these soils. Terraces are needed where cultivated crops are grown if crop residue is not kept on the surface throughout the year. Pastures need good management, including fertilization, frequent irrigation, and rotation grazing. Capability units IIIe-4, dryland, and IIIe-2, irrigated; Hardland Slopes range site.

Berda loam, 3 to 5 percent slopes (BeC).—This gently sloping soil is in valleys. Areas are long and irregular in shape. They range from about 20 acres to 650 acres in size. The average slope is about 4 percent.

The profile of this soil is the one described as representative of the Berda series.

Included with this soil in mapping are Veal and Mobeetie soils and Berda and Mansker soils, 5 to 8 percent slopes. Also included are small areas of soils that are similar to this soil, but their surface layer is dark colored. These areas are at the edges of mapped areas. A few rills or gullies as much as 3 feet deep are included in some areas.

This soil is used mainly for range. The main crops grown are wheat and grain sorghum.

The hazard of erosion is moderate. Keeping crop residue on the surface and using residue-conserving tillage, contour farming, and terracing help control erosion and also maintain good tilth. Diversion terraces and grassed waterways are needed in places. Irrigated crops respond to fertilizer. Limited tillage and keeping crop residue on the surface reduce erosion. A sprinkler system of irrigation is best suited. Terraces are needed where cultivated crops are grown if crop residue is not kept on the surface throughout the year. Pastures need good management, including fertilization, frequent irrigation, and rotation grazing. Capability units IVe-4, dryland, and IVe-2, irrigated; Hardland Slopes range site.

Berda-Potter-Caliche outcrop association, steep (BPF).—This mapping unit is on caprock escarpments. Its composition is more variable and the acreage generally is much larger than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of these soils.

Berda soils make up about 60 percent of this mapping unit, Potter soils about 10 percent, and Caliche outcrop about 15 percent. The remaining 15 percent is Mobeetie and Likes soils and some areas of almost vertical cliffs. Berda soils are in elongated areas in valleys and are many miles long. These areas are 50 to 1,200 acres in size and average about 500 acres. They are broken by numerous drainage channels. One or more strata of hardened caliche caprocks are in these areas. Runoff is rapid, and geological erosion is active. The slope ranges from 20 to 45 percent, and the average slope is 25 percent.

Berda soils have a surface layer of brown loam about 9 inches thick. The next layer is light-brown sandy clay loam about 21 inches thick. Below that, to a depth of 48 inches, is light-brown sandy clay loam that is 5 percent calcium carbonate. The underlying material is brown sandy clay loam to a depth of 60 inches and is 17 percent calcium carbonate.

Potter soils have a surface layer of grayish-brown gravelly loam about 5 inches thick. The next layer is light-brown gravelly loam about 3 inches thick. The underlying material is white caliche to a depth of 48 inches.

Caliche outcrop consists of steep areas of bare caliche along draws and canyons. These areas are broken by numerous intermittent drainage channels. One or more layers of hardened caliche caprock are common in these areas, and there is little or no soil material where slopes are steep. The loamy calcareous material supports a thin cover of vegetation in some areas.

The soils and land type of this mapping unit could be separated, but because use and management are similar separation is not justified. This mapping unit is used for range and as wildlife habitat. Capability unit VIIs-1, dryland; Rough Breaks range site.

Berda and Mansker soils, 5 to 8 percent slopes (BSD).—This mapping unit is sloping. Its composition is more variable and the acreage generally is much larger than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of these soils.

Berda soils make up about 63 percent of this mapping unit, Mansker soils about 32 percent, and Mobeetie soils about 5 percent. Some areas have only Berda soils, some have Mansker soils, and some have both soils. Soil patterns are not uniform and occur without regularity. Mansker soils are on upper slopes, Berda soils are on side slopes, and Mobeetie soils are on foot slopes and in drainageways. The areas of these soils are 30 to 650 acres in size. They are long and irregular in shape. The average slope is about 7 percent.

Berda soils have a surface layer of brown loam about 8 inches thick. The next layer is light-brown loam about 10 inches thick. Below that, to a depth of 40 inches, is light yellowish-brown loam that is 6 percent calcium carbonate. The underlying material is very pale brown loam to a depth of 80 inches.

This mapping unit is in range. Capability unit VIe-1, dryland; Hardland Slopes range site.

Berda and Veal soils, 3 to 15 percent slopes (BVE).—This mapping unit is gently sloping and rolling. Its composition is more variable and the acreage generally is much larger than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of these soils.

Berda soils make up about 45 percent of this mapping unit, Veal soils about 32 percent, and Potter and Mobeetie soils about 23 percent. Some areas have only Berda soils, some have Veal soils, and some have both soils. Soil patterns are not uniform and occur without regularity. Berda soils are on side slopes below ridges, and Veal soils are on the upper part of side slopes below Potter soil. Potter soils are on ridges and sides of ridges, and Mobeetie soils are on foot slopes and in drainageways. The areas of these soils are longer than they are wide. They are 40 to 1,200 acres in size, and their average slope is 9 percent.

Berda soils have a surface layer of brown loam about 7 inches thick. The next layer is light-brown loam about 15 inches thick. Below that, to a depth of 38 inches, is light yellowish-brown loam that is 9 percent calcium carbonate. The underlying material is very pale brown loam to a depth of 60 inches.

Veal soils have a surface layer of brown fine sandy loam about 7 inches thick. The next layer is light-brown sandy clay loam about 8 inches thick. Below that, to a depth of 35 inches, is pale-brown sandy clay loam. The underlying material is pink fine sandy loam to a depth of 63 inches.

This mapping unit is in range. Capability unit VIe-1, dryland; Hardland Slopes range site.

Burson Series

The Burson series consists of shallow to very shallow, calcareous, steep loamy soils. One or more strata of hardened limestone crops out in these areas. These soils formed in material derived from sandstone and siltstone.

In a representative profile the surface layer is yellowish-red loam about 6 inches thick. The underlying material, to a depth of 40 inches, is reddish-yellow, weakly cemented sandstone and siltstone stratified with loam or silty clay loam.

Burson soils are well drained to excessively drained. Permeability is moderate, and the available water capacity is very low.

These soils are used for range.

Representative profile of Burson loam, in an area of Burson stony loam, steep, 5.5 miles south of courthouse in Stinnett on Texas Highway 152, 0.4 mile east:

A1—0 to 6 inches, yellowish-red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak, fine, granular structure; slightly hard, very friable; common roots; about 60 percent of surface is covered with limestone stones, cobbles, and pebbles, some of which are imbedded in the upper 1 inch; calcareous; moderately alkaline; clear, wavy boundary.

C—6 to 40 inches, reddish-yellow (5YR 6/6), weakly cemented sandstone and siltstone and stratified loam or silty clay loam; calcareous; moderately alkaline.

The depth to sandstone or siltstone ranges from 3 to 12 inches. The A1 horizon is red, yellowish-red, or reddish-gray loam, silt loam, very fine sandy loam, or silty clay loam. Fragments of limestone that have sluffed off the outcrops cover 40 to 60 percent of the surface layer. They are about ½ inch to 6 feet across their axis. The C horizon ranges from red to reddish yellow. It is weakly to strongly consolidated with strata of soft, loamy or silty material.

Burson stony loam, steep (BxF).—This steep soil is in areas that are 40 to 1,600 acres in size. This soil is in elongated areas in valleys. Runoff is rapid, and geological erosion is active. One or more strata of hardened limestone crops out in these areas. Fragments of limestone cover 40 to 60 percent of the surface layer, and they are mainly 6 inches to 6 feet across their axis.

The slope ranges from 20 to 45 percent.

Included with this soil in mapping are Tascosa, Obaro, Quinlan, Likes, and Veal soils. Also included are some cliffs that are almost vertical.

This soil is used for range. Capability unit VIIs-1, dryland; Rough Breaks range site.

Caliche Outcrop

Caliche outcrop consists of steep, exposed caliche along draws and canyons. The areas of this land type are broken by numerous intermittent drainage channels and are characterized by one or more strata of hardened caliche caprock. There is little or no soil material where slopes are steep, but the loamy calcareous material supports a thin cover of vegetation in some areas.

Caliche outcrop is mapped only in an association with Berda and Potter soils.

Clairemont Series

The Clairemont series consists of deep, calcareous loamy soils that are nearly level and are in broad areas on flood plains. These soils formed in alluvial material.

In a representative profile the surface layer is reddish-brown silt loam about 7 inches thick. The next layer is reddish-brown stratified silt loam about 23 inches thick. Below that, to a depth of 45 inches, is reddish-brown, stratified silty clay loam. The underlying material is reddish-brown, stratified silty clay loam to a depth of 60 inches.

Clairemont soils are well drained. Permeability is moderate, and the available water capacity is high. Runoff is slow.

Most areas of these soils are in range, but a few areas are farmed.

Representative profile of Clairemont silt loam, 0.3 mile south of the Canadian River Bridge on Texas Highway 207, 1.0 mile west on road, 500 feet west of house, on flood plain of small creek:

A1—0 to 7 inches, reddish-brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak, granular and weak, subangular blocky structure; hard, friable; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C1—7 to 20 inches, reddish-brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; massive; hard, friable; faint bedding planes; few to common worm casts; few films and threads of calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

C2—20 to 30 inches, reddish-brown (5YR 5/4) silt loam, reddish brown (5YR 5/4) moist; massive; slightly hard, very friable; few strata of silt loam, silty clay loam, and very fine sand as much as ½ inch thick; few threads of salt; calcareous; moderately alkaline; clear, smooth boundary.

Ab—30 to 45 inches, reddish-brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; massive parting to granular; hard, friable; faint bedding planes; thin strata of finer and coarser textured material; calcareous; moderately alkaline; clear, smooth boundary.

Cb—45 to 60 inches, reddish-brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; faint bedding planes; few threads and films of salt; calcareous; moderately alkaline.

The A1 horizon ranges from 6 to 14 inches in thickness. It ranges from dark reddish brown to reddish brown. The C1 horizon ranges from 10 to 15 inches in thickness. It is dark reddish-brown to reddish-brown silt loam to loam. The B2 horizon ranges from 10 to 28 inches in thickness. It is dark reddish-brown to reddish-brown silt loam to silty clay loam. The Ab horizon is dark reddish-brown to reddish-brown loam to silty clay loam.

Clairemont silt loam (Ca).—This nearly level soil is in channeled areas on flood plains. The areas of this soil are 15 to 40 acres in size. Flooding occurs once every 1 to 5 years. The slope ranges from 0 to 1 percent.

Included with this soil in mapping are Obaro, Berda, Likes, Mobeetie, and Lincoln soils.

This soil is used mainly for range. A small acreage is used for dryland farming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is slight. Good management includes keeping crop residue on the surface when crops are not grown, timely but limited tilling, and rotating crops. Diversion terraces and grassed waterways are needed in places. Irrigated areas need fertilization, residue management, crop rotation, timely but limited tillage, and a system that regulates the irrigation water to maintain good tilth. Capability units IIw-1, dryland, and IIw-1, irrigated; Loamy Bottomland range site.

Conlen Series

The Conlen series consists of deep, calcareous loamy soils that are nearly level to gently sloping on uplands. These soils formed in loamy, calcareous eolian material.

In a representative profile the surface layer is dark grayish-brown loam about 10 inches thick. The next layer is clay loam about 50 inches thick. In the upper 6 inches this layer is light brown, below that it is pinkish white, and in the lowermost 26 inches it is pinkish gray. The underlying material is reddish-yellow clay loam to a depth of 80 inches.

Conlen soils are well drained. Permeability is moderate, and the available water capacity is medium. Runoff is medium to rapid.

The soils are used for crops and range.

Representative profile of Conlen loam, 1 to 3 percent slopes, 1.5 miles south on Texas Highway 136 from junction with Farm Road 281, 200 feet east:

A1—0 to 10 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; hard, friable; many fine pores; many worm casts; few fine films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B21ca—10 to 16 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate, fine, subangular blocky structure; hard, friable; many fine pores; many worm casts; common fine films, threads, and concretions of calcium carbonate, about 7 percent by volume; calcareous; moderately alkaline; clear, smooth boundary.

B22ca—16 to 34 inches, pinkish-white (7.5YR 8/2) clay loam, pinkish gray (7.5YR 7/2) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few fine pores; many films, threads, soft masses, and concretions of calci-

um carbonate, about 60 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

B23tca—34 to 60 inches, pinkish-gray (7.5YR 7/2) clay loam, strong brown (7.5YR 5/6) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few fine pores; few clay films; common films, threads, and concretions of calcium carbonate, about 12 percent by volume; calcareous; moderately alkaline; clear, smooth boundary.

B24t—60 to 80 inches, reddish-yellow (7.5YR 6/8) clay loam, strong brown (7.5YR 5/8) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few clay films; few films and threads of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 80 inches thick. Depth to the Bca horizon is 10 to 20 inches. The A horizon is dark grayish brown or brown. It ranges from 8 to 12 inches in thickness. The B21ca horizon is pale brown, light brown, grayish brown, or brown. It ranges from 5 to 9 inches in thickness. Visible carbonates in this horizon range from 5 to 10 percent by volume. The B22ca horizon is light brown, white, pinkish white, pink, or pinkish gray. It ranges from 10 to 25 inches in thickness. Calcium carbonate content in this horizon ranges from 20 to 75 percent. The B23tca horizon is yellowish red, pinkish gray, light red, or reddish yellow. It ranges from 19 to 26 inches in thickness. Calcium carbonate content ranges from 10 to 15 percent. The B24t horizon is reddish yellow or yellowish red.

Conlen soils are mainly north of the Canadian River in the mesic temperature zone, but a few are on breaks of the Canadian River. The soils on breaks are outside the range described for the Conlen series because they have a temperature of more than 59° F.

Conlen loam, 0 to 1 percent slopes (CnA).—This nearly level soil is in slightly convex areas. It is higher on the landscape than Sunray, Sherm, and Gruver soils and lower than Dumas and Veal soils. The areas of this soil are elongated, and some are rounded knobs. They are generally about 30 acres but range from 10 to 100 acres in size. The average slope is 0.6 percent.

The surface layer is dark grayish-brown loam about 10 inches thick. The next layer is brown clay loam that is about 6 inches thick and is 6 percent calcium carbonate. Below that, to a depth of about 40 inches, is white clay loam that is 50 percent calcium carbonate. The next layer is pinkish-gray clay loam that is about 22 inches thick and is 10 percent calcium carbonate. The underlying material is reddish-yellow clay loam to a depth of 80 inches.

Included with this soil in mapping are Dumas and Sunray soils.

This soil is used for range and for dryfarming and irrigated farming. The main crops grown are wheat, forage sorghum, and grain sorghum. The lack of moisture and the thick accumulation of calcium carbonate limit the growth of dry-farmed crops.

The hazard of soil blowing is moderate. Intensive use of small grain and sorghum and residue-conserving tillage helps control soil blowing and also maintains good tilth. Diversion terraces and grassed waterways are needed in places. Irrigated crops respond to fertilizer. Capability units IVe–2, dryland, and IIIe–4, irrigated; Hardland Slopes range site.

Conlen loam, 1 to 3 percent slopes (CnB).—This gently sloping soil is on convex ridges. The areas of this soil are about 20 acres to 300 acres in size. The slope is mainly about 2 percent

This soil has the profile described as representative of the Conlen series.

Included with this soil in mapping are Sunray, Potter, and Berda soils.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is moderate, and this soil needs management that helps reduce soil blowing. Small grains and sorghums combined with residue-conserving tillage help control soil blowing and also maintain tilth. Diversion terraces and grassed waterways may be needed to drain excess water in places. Irrigated crops respond to fertilizer. Irrigation systems designed and installed to account for the inherent soil limitations help control erosion. Capability units IVe–2, dryland, and IIIe–4, irrigated; Hardland Slopes range site.

Conlen loam, 3 to 5 percent slopes (CnC).—This gently sloping soil is on convex ridges and side slopes. It is higher on the landscape than Berda, Sunray, and Veal soils. The areas of this soil are about 15 acres to 100 acres in size. The slope is mainly about 4 percent.

The surface layer is dark grayish-brown loam about 8 inches thick. The next layer is light-brown loam about 8 inches thick. Below that, to a depth of 41 inches, is pinkish-gray clay loam that is 25 percent calcium carbonates. The next layer is pinkish-gray clay loam that is about 19 inches thick and is 12 percent calcium carbonates. The underlying material is reddish-yellow clay loam to a depth of 80 inches.

Included with this soil in mapping are Sunray, Potter, and Berda soils.

This soil is used mainly for range. Some small areas are used for dryfarming and irrigated farming. The crops grown are wheat, grain, sorghum, and forage sorghum. Small grains and sorghums combined with residue-conserving tilling, contour farming, and terracing help control soil blowing and maintain the good tilth. Irrigated crops respond to fertilizer. A sprinkler system that regulates the irrigation water is needed. Terraces are needed where cultivated crops are grown if crop residue is not kept on the surface throughout the year. Grassed waterways and diversion terraces are needed in places. Pastures need good management, including fertilization, frequent irrigation, and rotation grazing. Capability units IVe–4, dryland, and IVe–2, irrigated; Hardland Slopes range site.

Dallam Series

The Dallam series consists of deep, noncalcareous, loamy soils that are nearly level to gently sloping on uplands. These soils formed in loamy, calcareous material.

In a representative profile the surface layer is brown, noncalcareous fine sandy loam about 7 inches thick. The next layer is about 77 inches thick. In the upper 28 inches this layer is brown sandy clay loam. Below that, to a depth of 50 inches, it is light-brown sandy clay loam that is 13 percent calcium carbonate. In the next 20 inches it is reddish-yellow fine sandy loam that is about 7 percent calcium. In the lower 14 inches is light-brown fine sandy loam.

Dallam soils are well drained. Permeability is moderate, and the available water capacity is high. Runoff is slow.

These soils are used for crops and range.

Representative profile of Dallam fine sandy loam, 1 to 3 percent slopes, 0.3 mile south on Farm Road 280 from Farm Road 2171, on west side of road, in a pasture:

A1—0 to 7 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, granular structure; hard, friable; neutral; clear, smooth boundary.

B21t—7 to 16 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak, subangular blocky structure; hard, friable; few clay films, mildly alkaline; clear, smooth boundary.

B22t—16 to 35 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak, very coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; few fine pores; few clay films; calcareous; moderately alkaline; clear, smooth boundary.

B23tca—35 to 50 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; moderate, coarse, prismatic structure parting to weak, subangular blocky; hard, friable; few clay films; common films, threads, soft masses, and fine concretions of calcium carbonate, about 13 percent by volume; calcareous; moderately alkaline; clear, smooth boundary.

B24tca—50 to 70 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak, coarse, prismatic structure parting to weak, subangular blocky; hard, friable; few clay films; common films, threads, soft masses, and fine concretions of calcium carbonate, about 7 percent by volume; calcareous; moderately alkaline; clear, smooth boundary.

B25t—70 to 84 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak, coarse, prismatic structure; hard, friable; few clay films; few films, threads, soft masses, and fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to 90 inches or more in thickness. The A horizon is grayish brown, brown, or yellowish brown. It ranges from 6 to 12 inches in thickness. The B21t horizon is yellowish brown or brown. It ranges from 7 to 12 inches in thickness. The B22t horizon is yellowish brown or brown. It ranges from 19 to 22 inches in thickness. The B23tca horizon is light brown, light reddish brown, or pink. It ranges from 15 to 18 inches in thickness. The B24tca horizon is reddish-yellow or strong-brown fine sandy loam to sandy clay loam. It ranges from 16 to 20 inches in thickness. The B25t horizon is reddish-yellow, reddish-brown, or light-brown fine sandy loam to sandy clay loam.

Dallam fine sandy loam, 0 to 1 percent slopes (DaA).—This nearly level soil is in areas that range from about 20 acres to 150 acres in size.

The surface layer is brown fine sandy loam about 8 inches thick. The next layer is brown sandy clay loam about 10 inches thick. Below that, to a depth of 37 inches, is brown sandy clay loam. The next layer is light-brown sandy clay loam about 15 inches thick. Below that, to a depth of 72 inches, is reddish-yellow fine sandy loam. The underlying material is light-brown fine sandy loam to a depth of 84 inches.

Included with this soil in mapping are Dumas, Veal, and Mobeetie soils and Dallam soils that have slopes of as much as 3 percent.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazards of soil blowing and water erosion are moderate. Good management includes keeping crop residue on the surface when crops are not being grown, using timely but limited tillage, and rotating crops. Diversion terraces and grassed waterways are needed in places. Irrigated crops need fertilization, management of residue, rotation of crops, timely but limited tillage, and a system that regulates irrigation water to maintain good tilth. Capability units IIIe–3, dryland, and IIe–2, irrigated; Sandy Loam range site.

Dallam fine sandy loam, 1 to 3 percent slopes (DaB).—This gently sloping soil is on convex ridges. It is higher on the landscape than Veal soils and lower than Sunray and Dumas soils. The areas of this soil are 15 to about 250 acres in size. The slope is commonly about 2 percent.

This soil has the profile described as representative of the Dallam series.

Included with this soil in mapping are Dumas, Veal, and Sunray soils. Also included are Dallam soils that have slopes of less than 1 percent.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazards of soil blowing and water erosion are moderate. Good management includes keeping crop residue on the surface when crops are not being grown, using timely but limited tillage, and rotating crops. Contour farming and terraces are needed to control erosion except in areas where crops are drilled and stubble mulched. Diversion terraces and grassed waterways are needed in places. Irrigated crops need fertilization, management of residue, crop rotation, timely but limited tillage, and a system that regulates the irrigation water to maintain good tilth. Capability units IIIe–3, dryland, and IIIe–3, irrigated; Sandy Loam range site.

Dallam fine sandy loam, 3 to 5 percent slopes (DaC).—This gently sloping soil is on convex ridges and side slopes. It is higher on the landscape than Veal soils and lower than Sunray and Dumas soils. The areas of this soil are about 15 acres to 90 acres in size. The slope is commonly about 3 percent.

The surface layer is brown fine sandy loam about 6 inches thick. The next layer is brown sandy clay loam about 11 inches thick. Below that, to a depth of about 34 inches, is light-brown sandy clay loam. The next layer is strong-brown sandy clay loam about 16 inches thick. Below that, to a depth of about 68 inches, is reddish-yellow fine sandy loam. The underlying material is light-brown fine sandy loam to a depth of 80 inches.

Included with this soil in mapping are Berda, Veal, Dumas, Potter, and Mobeetie soils.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is moderate. Small grains and sorghums combined with residue-conserving tilling, contour farming, and terracing help control soil blowing and maintain good tilth. Irrigated crops need fertilizer and a sprinkler system that regulates the irrigation water. Terraces are needed where cultivated crops are grown if crop residue is not kept on the surface throughout the year. Grassed waterways and

diversion terraces are needed in places. Pastures need good management, including fertilization, frequent irrigation, and rotation grazing. Capability units IVe–3, dryland, and IVe–1, irrigated; Sandy Loam range site.

Dallam-Urban land complex, 0 to 3 percent slopes (DrB).—This complex consists of nearly level to gently sloping Dallam soils and Urban land. About 60 percent of this mapping unit is Dallam soils, 30 percent is Urban land, and 10 percent is Veal and Mobeetie soils. Most of the acreage is within the cities of Stinnett, Fritch, and Phillips. The average slope is 2 percent.

Dallam soils typically have a surface layer of brown fine sandy loam about 7 inches thick. The next layer is brown sandy clay loam about 34 inches thick. Below that, to a depth of 56 inches, is light-brown sandy clay loam. The underlying material is reddish-yellow fine sandy loam.

Urban land consists of areas taken up by buildings, parking lots, industrial plants, railways, streets, roads, and sidewalks. Much of the soil material has been altered by cuts and fills because the land is gently sloping.

Urban development can be limited because permeability can cause a sewage lagoon to fail, a steel pipeline can fail because of resistivity, and stabilizing cut and fill areas can be difficult. Not assigned to a capability unit or range site.

Dumas Series

The Dumas series consists of deep, noncalcareous, loamy soils that are nearly level to gently sloping on uplands. These soils formed in calcareous loamy material.

In a representative profile the surface layer is brown loam about 10 inches thick. The next layer is clay loam to a depth of 84 inches. In the upper 10 inches this layer is dark brown, in the next 16 inches it is light brown, and in the 10 inches below that it is pink and is 8 percent calcium carbonate. In the next 22 inches it is light brown and is 25 percent calcium carbonate, and in the lower 16 inches it is brown and is 12 percent calcium carbonate.

Dumas soils are well drained. Permeability is moderate. Runoff is slow to medium.

These soils are used for crops and range.

Representative profile of Dumas loam, 1 to 3 percent slopes, 0.6 mile west of intersection of Farm Road 281 and Farm Road 2171 on Farm Road 2171, 200 feet north of Farm Road 2171, in a pasture:

A1—0 to 10 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate, fine granular structure; hard, friable; few fine pores; neutral; clear, smooth boundary.

B21t—10 to 20 inches, dark-brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, friable; few clay films; mildly alkaline; clear, smooth boundary.

B22t—20 to 36 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate, fine subangular blocky structure; hard, friable; few clay films; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B23t—36 to 46 inches, pink (7.5YR 7/4) clay loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; hard, friable; few clay films; common films, threads, soft masses, and concretions of calcium carbonates, about 8 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—46 to 68 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak, subangular blocky structure; hard, friable; few clay films; few films, threads, soft masses, and concretions of calcium carbonate, about 25 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

B25tca—68 to 84 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak, subangular blocky structure; hard, friable; few clay films; common films, threads, soft masses, and concretions of calcium carbonate, about 12 percent by volume; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The A horizon is brown or dark brown, and it ranges from loam to clay loam. It ranges from 6 to 12 inches in thickness. The B21t horizon is brown or dark brown. It ranges from 5 to 11 inches in thickness. The B22t horizon is grayish brown, light brown, or brown. It ranges from 8 to 12 inches in thickness. Clay content in this horizon ranges from 22 to 35 percent. The B23t horizon is pink, light brown, or brown. It ranges from 10 to 15 inches in thickness. The 24tca horizon is pink or light brown. It ranges from 10 to 14 inches in thickness. Calcium carbonate content in this horizon ranges from 5 to 25 percent by volume. The B25t horizon is reddish yellow, brown, or strong brown. It ranges from 20 to 24 inches in thickness. The B26tca horizon, where present, is brown or strong brown. Calcium carbonate content of this horizon ranges from 5 to 15 percent by volume.

Dumas loam, 0 to 1 percent slopes (DsA).—This soil is nearly level. It is in weakly convex to concave areas that range from 20 acres to 100 acres in size.

The surface layer is brown loam about 8 inches thick. The next layer is dark-brown clay loam about 2 inches thick. Below that, to a depth of 24 inches, is brown clay loam. The next layer is light-brown clay loam about 12 inches thick. Below that, to a depth of 48 inches, is pink clay loam that is 11 percent calcium carbonate by volume. The next layer is brown clay loam about 20 inches thick. The underlying material is brown clay loam to a depth of 80 inches.

Included with this soil in mapping are Dallam, Veal, Berda, and Sunray soils.

This soil is used for range and for dryfarming and irrigated farming. The main crops grown are wheat, corn, grain sorghum, and forage sorghum, but some alfalfa and vegetables are also grown.

The hazard of soil blowing is slight. Management should include rotating crops and keeping crop residue on the surface as long as possible. Timely but limited tillage, terraces, diversions, and grassed waterways are also important. Irrigated crops need fertilizer and a system that regulates the irrigation water to maintain good tilth. Capability units IIIe–6, dryland, and IIe–1, irrigated; Clay Loam range site.

Dumas loam, 1 to 3 percent slopes (DsB).—This gently sloping soil is on convex ridges. The areas of this soil are 20 acres to 250 acres in size. The slope is commonly about 2 percent.

This soil has the profile described as representative of the Dumas series.

Included with this soil in mapping are Dallam, Veal, Berda, and Sunray soils.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is moderate, and this soil needs management that helps reduce soil blowing. Small grains and sorghum combined with residue-conserving tillage help control soil blowing and maintain good tilth. Diversion terraces and grassed waterways may be needed to drain excess water in places. Irrigated crops respond to fertilizer. Irrigation systems designed and installed to account for the inherent soil limitations help control erosion. Capability units IIIe–2, dryland, and IIIe–2, irrigated; Clay Loam range site.

Dumas clay loam, 0 to 1 percent slopes (DuA).—This nearly level soil is on low, convex ridges. The areas of this soil are about 15 acres to 150 acres in size.

The surface layer is brown clay loam about 9 inches thick. The next layer is dark-brown clay loam about 8 inches thick. Below that, to a depth of 26 inches, is brown clay loam. The next layer is pink clay loam about 14 inches thick. Below that, to a depth of 54 inches, is light-brown clay loam. The underlying material is brown clay loam to a depth of 80 inches.

Included with this soil in mapping are Sherm, Conlen, Sunray, Gruver, and Ness soils.

This soil is used for range and for dryfarming and irrigated farming. The main crops grown are wheat, corn, grain sorghum, and forage sorghum, but some alfalfa and vegetables are also grown.

The hazard of soil blowing is slight. Keeping crop residue on the surface helps control soil blowing and erosion and also maintains good tilth. Diversion terraces and grassed waterways are needed in places. Irrigated crops need fertilizer and a system that regulates the irrigation water to maintain good tilth. Capability units IIIe–6, dryland, and IIe–1, irrigated; Clay Loam range site.

Gruver Series

The Gruver series consists of deep, noncalcareous loamy soils that are nearly level to gently sloping on uplands. These soils formed in eolian material.

In a representative profile the surface layer is brown, neutral clay loam about 7 inches thick. The next layer is clay loam to a depth of 80 inches. In the upper 17 inches this layer is brown, in the 24 inches below that it is light brown, and in the next 18 inches it is pink and is 22 percent calcium carbonate by volume.

Gruver soils are well drained. Permeability is moderately slow, and the available water capacity is high. Runoff is slow.

Most areas of these soils are used for crops, but a few areas are in native range.

Representative profile of Gruver clay loam, 0 to 1 percent slopes, 14 miles north of the courthouse in Stinnett on Texas Highway 207, 2.9 miles east on Farm Road 281, 4 miles south, 0.75 mile east, on north side of road, in a cultivated field:

Ap—0 to 7 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; hard, friable; neutral; abrupt, smooth boundary.

B21t—7 to 15 inches, brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; hard, friable; few fine pores; few clay films; few worm casts; mildly alkaline; gradual, smooth boundary.

B22t—15 to 24 inches, brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate, medium, blocky structure; very hard, firm; few fine pores; few clay films; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—24 to 48 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; hard, friable; few fine pores; few clay films; few films and threads of calcium carbonate in lower part; calcareous; moderately alkaline; gradual, wavy boundary.

B24tca—48 to 66 inches, pink (7.5YR 7/4) clay loam, reddish yellow (7.5YR 6/6) moist; weak, fine, subangular blocky structure; hard, friable; few fine pores; few clay films; many films, threads, soft masses, and concretions of calcium carbonate, about 22 percent by volume; calcareous; moderately alkaline; clear, smooth boundary.

B25tca—66 to 80 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, fine, subangular blocky structure; hard, friable; few clay films; few films, threads, soft masses, and concretions of calcium carbonate, about 17 percent by volume; calcareous; moderately alkaline.

Depth to the Bca horizon ranges from 46 to 50 inches. The A horizon ranges from 6 to 8 inches in thickness. It is brown, grayish brown, or dark grayish brown. The B21t horizon ranges from 7 to 9 inches in thickness. It is dark brown or brown. It ranges from silty clay loam to clay loam. The B22t horizon ranges from 8 to 12 inches in thickness. The B23t horizon ranges from 20 to 26 inches in thickness. It ranges from brown to reddish yellow. The B24tca horizon ranges from 16 to 24 inches in thickness. It ranges from pink to light brown. Calcium carbonate content in this horizon ranges from 15 to 25 percent by volume, and in the B25tca horizon it is 7 to 20 percent.

Gruver clay loam, 0 to 1 percent slopes (GrA).—This nearly level soil is in broad areas.

The profile of this soil is the one described as representative of the Gruver series.

Included with this soil in mapping are Conlen, Ness, and Sherm soils.

This soil is used mainly for dryland and irrigated crops, including wheat, corn, grain sorghum, forage sorghum, and some alfalfa and vegetables. Some small areas are in range.

The hazard of soil blowing is slight. Management should include rotating crops and keeping crop residue on the surface as long as possible. Timely but limited tillage, terraces, diversions, and grassed waterways are also important. Irrigated crops need fertilizer and a system that regulates the irrigation water to maintain good tilth. Capability units IIIe–6, dryland, and IIe–1, irrigated; Clay Loam range site.

Gruver clay loam, 1 to 3 percent slopes (GrB).—This gently sloping soil is in convex areas that range from about 15 acres to 100 acres in size. The slope is commonly about 2 percent.

The surface layer is brown clay loam about 6 inches thick. The next layer is brown clay loam about 19 inches thick. Below that, to a depth of 50 inches, is reddish-yellow clay loam. The next layer is pink clay loam that is about 16 inches thick and is 22 percent calcium carbonate. The underlying material is reddish-yellow clay loam to a depth of 80 inches.

Included with this soil in mapping are Conlen, Sherm, and Sunray soils. Also included are some soils that have slopes of less than 1 percent.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is slight. Good management includes keeping crop residue on the surface when crops are not being grown, timely but limited tillage, and rotating crops. Contour farming combined with terraces are needed to control erosion except if crops are drilled and stubble mulched where slopes are short. Diversion terraces and grassed waterways are needed in places. Irrigated crops need fertilizer and a system that regulates irrigation water so that good tilth is maintained. Capability units IIIe–2, dryland, and IIIe–2, irrigated; Clay Loam range site.

Humbarger Series

The Humbarger series consists of deep, calcareous loamy soils that are nearly level on broad flood plains. These soils formed in calcareous loamy alluvium.

In a representative profile the surface layer is dark grayish-brown calcareous clay loam about 18 inches thick. Below that, to a depth of 40 inches, is grayish-brown calcareous clay loam. The underlying material is light brownish-gray loam to a depth of 60 inches or more.

Humbarger soils are well drained to moderately well drained. Permeability is moderate, and the available water capacity is high. Runoff is slow. These soils are subject to occasional flooding.

Most areas of these soils are in range, but a small acreage is dry-farmed.

Representative profile of Humbarger clay loam, channeled, 1 mile west from Texas Highway 136 on Farm Road 281, 0.6 mile south, and 100 feet east, in pasture:

A11—0 to 18 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, subangular blocky structure; hard, firm; common roots; common worm casts; calcareous; moderately alkaline; clear, smooth boundary.

A12—18 to 40 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; hard, firm; thin stratification of sandy material; few films and threads of calcium carbonate; few worm casts; calcareous; moderately alkaline; clear, smooth boundary.

C—40 to 60 inches, light brownish-gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; few films and threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 38 to 45 inches in thickness. The A11 horizon is dark grayish brown, grayish brown, or brown. The A12 horizon is grayish brown or brown. The C horizon is light brownish gray or pale brown. It ranges from loam to clay loam.

Humbarger clay loam (Hm).—This nearly level soil is in concave areas in valleys. The areas of this soil are 150 to 1,000 feet wide and are in elongated patterns in the valleys. The average slope is about 0.4 percent.

The surface layer is dark grayish-brown clay loam about 24 inches thick. The next layer is brown clay loam about 14 inches thick. Below that, to a depth of 52 inches, is grayish-brown clay loam that is 4 percent calcium carbonate. The underlying material is pale-brown clay loam to a depth of 80 inches.

Included with this soil in mapping are Humbarger clay loam, channeled, and Berda and Yahola soils.

This soil is used for crops and for range. The main crops grown are wheat, forage sorghum, and grain sorghum.

The main concern of management is maintaining soil tilth; keeping crop residue on the surface and timely but limited tillage are needed. Terraces, diversions, and grassed waterways may be needed to drain excess water in places. Fertilizer, crop-residue management, crop rotation, and a system that regulates the irrigation water are needed to maintain good tilth where irrigated crops are grown. Capability units IIe–1, dryland, and IIe–1, irrigated; Valley range site.

Humbarger clay loam, channeled (Hu).—This nearly level soil is on flood plains and in channels. It is slightly lower on the landscape than Humbarger clay loam. Streambanks are short and steep, and some areas of this soil have several secondary flood channels. The areas of this soil are from 100 to 800 feet wide and are in elongated patterns on stream flood plains. The average slope is about 0.6 percent.

This soil has the profile described as representative of the Humbarger series.

Included with this soil in mapping are Humbarger clay loam, Lincoln soils, and Yahola fine sandy loam.

This soil is used mainly for range. Capability unit Vw–1, dryland; Valley range site.

Likes Series

The Likes series consists of deep, calcareous sandy soils that are gently sloping to sloping in valleys. These soils formed in unconsolidated sandy material.

In a representative profile the surface layer is brown, calcareous loamy fine sand about 6 inches thick. The underlying material is calcareous loamy fine sand to a depth of 80 inches or more. In the upper 28 inches this layer is pale brown, and in the lower 46 inches it is very pale brown.

Likes soils are excessively drained. Permeability is moderately rapid, and the available water capacity is low. Runoff is slow.

Most areas of these soils are in range.

Representative profile of Likes loamy fine sand, 1 to 6 percent slopes, 3.8 miles east of Stinnett railroad crossing on Farm Road 1526 and county road, 200 feet north, in a pasture:

A1—0 to 6 inches, brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak, granular structure; loose, very friable; few concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C1—6 to 34 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose; few to common concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C2—34 to 80 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; few to common concretions of calcium carbonate; calcareous; moderately alkaline.

Depth to carbonates ranges from 0 to 30 inches. The A horizon is light grayish brown or brown. It ranges from 5 to 7 inches in thickness. The C1 horizon is very pale brown, pale brown, or brown. It ranges from 23 to 29 inches in thickness. The C2 horizon ranges from very pale brown to pale brown.

Likes loamy fine sand, 1 to 6 percent slopes (LkC).—This gently sloping to sloping soil is in the larger drains in valleys. The areas of this soil are about 200 acres, but they range from 20 to more than 1,000 acres in size. The slope is mainly about 5 percent.

The profile of this soil is the one described as representative of the Likes series.

Included with this soil in mapping are Mobeetie, Berda, Veal, and Tivoli soils. Also included are some Likes soils that have slopes of as much as 8 percent.

This soil is used mainly for range, and it is not suited to crops. Capability unit VIe–1, dryland; Sandy range site.

Lincoln Series

The Lincoln series consists of deep, calcareous, sandy soils on flood plains. These soils formed in recent sandy alluvial material.

In a representative profile the surface layer is grayish-brown, calcareous loamy fine sand about 14 inches thick. The underlying material is light yellowish-brown loamy fine sand to a depth of 60 inches or more.

Lincoln soils are somewhat excessively drained. Permeability is rapid, and the available water capacity is low. Runoff is slow. This soil is subject to flooding one to three times in most years. The water table is at a depth of 36 to 60 inches.

Most areas of these soils are in range.

Representative profile of Lincoln soils, 5.8 miles southeast of Texas Highway 152 on Farm Road 2277, east 0.2 mile, in Canadian River bottom land:

A1—0 to 14 inches, grayish-brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak, granular structure; soft, very friable; few ½-inch strata of silt loam, very fine sandy loam, and fine sandy loam; calcareous; moderately alkaline; clear, smooth boundary.

C—14 to 63 inches, light yellowish-brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; massive; loose; thin stratified coarse sand and gravel and clayey material; water table at a depth of 48 inches, calcareous; moderately alkaline.

The A horizon is light brown or grayish brown. It ranges from 7 to 15 inches in thickness. It ranges from fine sand to loamy fine sand. The C horizon is very pale brown or light yellowish brown. It ranges from fine sand to loamy fine sand.

Lincoln soils (Ln).—This nearly level mapping unit is on plains. These soils are subject to flooding one to three times a year, and as a result the surface layer is not stable and it varies in texture. Flooding lasts only 1 to 5 hours. The water table is at a depth of 36 to 60 inches. The areas of these soils are long and narrow along drainageways, and they are about 20 acres to several thousand acres in size.

The texture of the surface layer varies. In most places it is loamy fine sand and fine sand, but in some places it is only loamy fine sand. Soil patterns are not uniform.

Included with these soils in mapping are Yahola, Sweetwater, Likes, and Tivoli soils.

This mapping unit is used mainly for range, and a few areas are used as wildlife habitat (fig. 3). Capability unit Vw–1, dryland; Sandy Bottomland range site.

Figure 3.—**An area of Lincoln soils that is good habitat for quail, turkey, and deer.**

Mansker Series

The Mansker series consists of deep, calcareous, loamy soils that are sloping on uplands. These soils formed in calcareous loamy material.

In a representative profile the surface layer is brown calcareous loam about 9 inches thick. The next layer is 59 inches thick. In the upper 7 inches this layer is light-brown calcareous loam, in the 22 inches below that it is pink calcareous clay loam that is about 50 percent calcium carbonates, and in the lower 30 inches it is pink, calcareous clay loam.

Mansker soils are well drained. Permeability is moderate, and the available water capacity is medium. Runoff is rapid.

These soils are used for range.

Mansker soils are mapped only in an undifferentiated unit with Berda soils.

Representative profile of Mansker loam, in an area of Berda and Mansker soils, 5 to 8 percent slopes, 4.6 miles northeast of intersection of Texas Highways 207 and 136 near Pringle, 1.7 miles east on county road, 0.4 mile east and 50 feet south in a pasture:

A1—0 to 9 inches, brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak, granular structure; hard, friable; many fine pores; many worm casts; few fine films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B21ca—9 to 16 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; moderate, fine, subangular blocky structure; hard, friable; many fine pores; many worm casts; common fine films, threads, and concretions of calcium carbonate, about 7 percent by volume; calcareous; moderately alkaline; clear, smooth boundary.

B22ca—16 to 38 inches, pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few fine pores; many films, threads, soft masses, and concretions of calcium carbonate, about 50 percent by volume; calcareous; moderately alkaline; diffuse, wavy boundary.

B23tca—38 to 68 inches, pink (7.5YR 7/4) clay loam, strong brown (7.5YR 5/6) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few fine pores; common films, threads, and concretions of calcium carbonate, about 8 percent by volume; moderately alkaline.

The solum is more than 60 inches thick. Depth to the B2ca horizon ranges from 10 to 18 inches. The A horizon is 8 to 12 inches thick. It is dark grayish brown or brown. Clay content in this horizon ranges from 18 to 30 percent. The B21ca horizon is light brown or very pale brown. It ranges from 6 to 9 inches in thickness. Calcium carbonate content ranges from 3 to 10 percent by volume. The B22ca horizon is red, pink, or yellowish red. It ranges from 12 to 22 inches in thickness. Calcium carbonate content ranges from 40 to 60 percent by volume. The B23tca horizon is pink or light reddish brown. Calcium carbonate content ranges from 8 to 15 percent by volume.

Mobeetie Series

The Mobeetie series consists of deep, calcareous, loamy soils that are gently sloping to moderately steep. These soils are on foot slopes and alluvial fans in valleys. They formed in alluvium.

In a representative profile the surface layer is grayish-brown fine sandy loam about 8 inches thick. The next layer is fine sandy loam about 34 inches thick. In the upper 17 inches this layer is light brownish gray, and in the lower 17 inches it is pale brown. The underlying material is light yellowish-brown fine sandy loam to a depth of 80 inches (fig. 4).

Figure 4.—**An area of Mobeetie fine sandy loam, 1 to 3 percent slopes, where there is an excellent stand of reseeded tall grasses.**

Mobeetie soils are well drained. Permeability is moderately rapid, and the available water capacity is medium. Runoff is medium.

Most areas of these soils are in range, but a few areas are farmed.

Representative profile of Mobeetie fine sandy loam, 5 to 12 percent slopes, 0.75 mile north of courthouse in Stinnett on Texas Highway 207, 300 feet east, in a pasture:

A1—0 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate, coarse, prismatic structure parting to weak, fine, subangular blocky; slightly hard, very friable; few very fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

B2—8 to 25 inches, light brownish-gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak, coarse, prismatic structure parting to weak, medium and fine, subangular blocky; slightly hard, very friable; few worm casts; few threads, films, and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—25 to 42 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak, coarse, prismatic structure parting to weak, subangular blocky; slightly hard, friable; common threads, films, soft masses, and concretions of calcium carbonate, about 4 percent by volume; calcareous; moderately alkaline; diffuse, smooth boundary.

C—42 to 80 inches, light yellowish-brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; few threads, films, and medium to very fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 32 to 53 inches in thickness. The A horizon is grayish brown or brown. It ranges from 7 to 10 inches in thickness. The B2 horizon is light brownish gray or brown. It ranges from 10 to 17 inches in thickness. The B3ca horizon is very pale brown or pale brown. It ranges from 16 to 24 inches in thickness. Calcium carbonate content in this horizon ranges from 3 to 10 percent by volume. The C horizon is light yellowish brown or very pale brown.

Mobeetie soils are near the mesic-thermic line, and most are in the thermic zone. Some Mobeetie soils have a temperature ranging from 56° to 59° F and are outside the range described for the Mobeetie series.

Mobeetie fine sandy loam, 1 to 3 percent slopes (MbB).—This gently sloping soil is in valleys. The areas of this soil are about 15 acres to 150 acres in size. The slope is mainly about 2 percent.

The surface layer is grayish-brown fine sandy loam 8 inches thick. The next layer is light brownish-gray fine sandy loam 18 inches thick. Below that, to a depth of 48 inches, is pale-brown fine sandy loam that is 4 percent calcium carbonate. The underlying material is light yellowish-brown fine sandy loam to a depth of 80 inches.

Included with this soil in mapping are Berda, Veal, Likes, and Potter soils. The Potter soils are on caps and small knolls. Also included are some small areas of soils that have slopes of more than 3 percent. These areas are on the edges of the mapped areas.

This soil is used for range and for dryfarming and irrigated farming. The main crops grown are wheat, grain sorghum, and forage sorghum, but alfalfa is grown in some areas.

The hazard of soil blowing is moderate, and this soil needs management that helps reduce soil blowing. Small grain and sorghum combined with residue-conserving tillage helps control soil blowing and maintain good tilth. Diversion terraces and grassed waterways may be needed to drain excess water in places. Irrigated crops respond to fertilizer. Irrigation systems designed and installed to account for the inherent soil limitations help control erosion. Capability units IVe–1, dryland, and IIIe–3, irrigated; Mixedland Slopes range site.

Mobeetie fine sandy loam, 3 to 5 percent slopes (MbC).—This gently sloping soil is in valleys. The areas of this soil are about 30 acres to 600 acres in size and are much longer than wide. The slope is mainly about 4 percent.

The surface layer is grayish-brown fine sandy loam about 8 inches thick. The next layer is light brownish-gray fine sandy loam about 16 inches thick. Below that, to a depth of 48 inches, is pale-brown fine sandy loam that is 5 percent calcium carbonate by volume. The underlying material is light yellowish-brown fine sandy loam to a depth of 80 inches.

Included with this soil in mapping are Berda, Veal, Likes, and Potter soils. The Potter soil is on caps and small knolls. Also included are some soils that have slopes of more than 5 percent and some that have slopes of less than 3 percent. These small areas are at the edges of mapped areas. A few rills or gullies as much as 5 feet deep are included in some mapped areas.

This soil is used mainly for range.

Unprotected areas of this soil erode. Dry-farmed areas need crops that produce large amounts of cover and residue to protect the soil. Drilled crops that are stubble mulched are needed to control erosion and also to maintain good tilth. Diversion terraces and grassed waterways are needed in places. Irrigated crops need fertilizers and a sprinkler system that regulates the irrigation water. Contour farming and terraces are needed. Capability units IVe–3, dryland, and IVe–1, irrigated; Mixedland Slopes range site.

Mobeetie fine sandy loam, 5 to 12 percent slopes (MbD).—This sloping to strongly sloping soil is in valleys. The areas of this soil are about 25 acres to about 700 acres in size and are longer than wide. The slope is mainly about 7 percent.

The profile of this soil is the one described as representative of the Mobeetie series.

Included with this soil in mapping are Berda, Likes, and Potter soils. Also included are soils that have slopes of less than 5 percent. These small areas are at the edges of mapped areas. A few rills or gullies as much as 5 feet deep are included in some mapped areas.

This soil is used for range, and it is not suited to crops. Capability unit VIe–2, dryland; Mixedland Slopes range site.

Mobeetie and Veal soils, 5 to 20 percent slopes (MVE).—This mapping unit is gently sloping to moderately steep. Its composition is more variable and the acreage generally is larger than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of these soils.

Mobeetie soils make up 53 percent of this mapping unit, Veal soils about 25 percent, and Potter, Likes, and Berda soils about 22 percent. Some areas have only the Mobeetie soils, some have Veal soils, and others have both. Soil patterns are not uniform and occur without regularity. Mobeetie soils are on side slopes,

and Veal soils are on ridges. Areas are longer than wide and range from 40 to 1,500 acres in size. The average slope is 12 percent.

Mobeetie soils have a surface layer of grayish-brown fine sandy loam about 7 inches thick. The next layer is light brownish-gray fine sandy loam about 15 inches thick. Below that, to a depth of 44 inches, is pale-brown fine sandy loam that is 7 percent calcium carbonate. The underlying material is very pale brown fine sandy loam to a depth of 80 inches.

Veal soils have a surface layer of brown fine sandy loam about 5 inches thick. The next layer is pale-brown sandy clay loam about 11 inches thick. Below that, to a depth of 33 inches, is pinkish-gray sandy clay loam. The underlying material is pink sandy clay loam to a depth of 60 inches.

This mapping unit is in range, and it is not suited to crops. Capability unit VIe–2, dryland; Mixedland Slopes range site.

Ness Series

The Ness series consists of deep, noncalcareous clayey soils that are nearly level. These soils formed in clayey alluvium on the floors of playas. They are under water a few weeks to several months each year.

In a representative profile the surface layer is gray noncalcareous clay about 10 inches thick. The next layer is gray noncalcareous clay about 34 inches thick. The underlying material is pale-brown silty clay loam to a depth of 80 inches or more.

Ness soils are poorly drained. Permeability is very slow, and the available water capacity is high. Runoff is ponded.

Most areas of these soils are in range.

Representative profile of Ness clay, 2.8 miles east of intersection of Texas Highway 207 and Farm Road 281, 1.0 mile north and 0.2 mile east on county road, 100 feet north, in a pit in a playa:

A11—0 to 10 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak, coarse, blocky structure; extremely hard, extremely firm; neutral; gradual, smooth boundary.

A12—10 to 44 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak, coarse, blocky structure; extremely hard, extremely firm; few, small, black concretions; mildly alkaline; diffuse, smooth boundary.

C—44 to 80 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; massive; very hard, firm; few, faint, strong-brown mottles; mildly alkaline.

The solum ranges from 34 to 50 inches in thickness. The A11 horizon ranges from 6 to 12 inches in thickness. It is dark gray or gray. The A12 horizon ranges from 28 to 41 inches in thickness. It is dark gray or gray. The C horizon is light gray, light brownish gray, or pale brown. It ranges from clay loam to silty clay loam.

Ness soils are near the mesic-thermic line, and most are in the mesic zone. Some Ness soils have a temperature of more than 59° F and are outside the range described for the Ness series.

Ness clay (Ne).—This nearly level soil is on floors of intermittent lakes, or playas. Most areas of this soil are oval and in concave depressions that range from 1 to 30 feet below the surrounding plain. These areas are a few acres to a few hundred acres in size and average about 40 acres.

Included with this soil in mapping are narrow areas of sloping Sherm and Gruver soils.

Unless this soil is drained, it cannot be used for crops because it is subject to periodic flooding. Water collects in depressions and remains until it evaporates. Some of these areas are used for grazing, and pits can be dug in these areas to provide water for the livestock.

The hazard of soil blowing is moderate. If drained areas are dryfarmed, good management includes smoothing or leveling the surface layer if needed, controlling outside water, keeping crop residue on the surface, and using limited tillage. Capability units VIw–1, dryland, and IVs–1, drained; included in adjoining range site.

Obaro Series

The Obaro series consists of moderately deep, calcareous, loamy soils on uplands. These soils are gently sloping to strongly sloping and rolling; they formed in material derived from weakly consolidated, fine-grained, calcareous sandstone.

In a representative profile the surface layer is reddish-brown loam about 8 inches thick. The next layer is reddish-brown loam about 10 inches thick. Below that, to a depth of 37 inches, is red loam that is 10 percent calcium carbonate. The underlying material is light-red, weakly cemented, calcareous sandstone to a depth of 60 inches or more.

Obaro soils are well drained. Permeability is moderate, and the available water capacity is medium. Runoff is medium.

Most areas of these soils are in range, but a few areas are farmed.

Representative profile of Obaro loam, in an area of Obaro and Quinlan soils, rolling, 2,200 feet north of end of Hutchinson County airfield north of Borger, 250 feet south of road Y, in a pasture:

A1—0 to 8 inches, reddish-brown (5YR 5/4) loam, dark reddish-brown (5YR 3/4) moist; weak, subangular blocky structure; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

B2—8 to 18 inches, reddish-brown (2.5YR 5/4) loam, dark reddish-brown (2.5YR 3/4) moist; weak, prismatic structure parting to moderate, medium, subangular blocky; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

B3ca—18 to 37 inches, red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, friable; common films, threads, soft masses, and concretions of calcium carbonate, about 10 percent by volume; calcareous; moderately alkaline; clear, smooth boundary.

C—37 to 60 inches, light-red (2.5YR 6/6), weakly cemented, calcareous sandstone, red (2.5YR 5/6) moist.

The A1 horizon ranges from 5 to 12 inches in thickness. It is brown or reddish brown. The B2 horizon ranges from 9 to 14 inches in thickness. It is light reddish brown or reddish brown. The B3ca horizon ranges from 14 to 20 inches in thickness. It is red or light red. Calcium carbonate content in this horizon ranges from 8 to 15 percent. The C horizon is red or light red. The sandstone ranges from weakly cemented to strongly cemented. Depth to the C horizon ranges from 28 to 40 inches.

Obaro loam, 1 to 3 percent slopes (ObB).—This gently sloping soil is in convex areas that range from about 20 acres to 200 acres in size. The slope is mainly about 2 percent.

The surface layer is reddish-brown loam about 8 inches thick. The next layer is reddish-brown loam about 12 inches thick. Below that, to a depth of about 38 inches, is red loam that is 8 percent calcium carbonate. The underlying material is light-red loam to a depth of 80 inches.

Included with this soil in mapping are Quinlan, Dumas, and Dallam soils.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is moderate, and this soil needs management that helps reduce soil blowing. Keeping crop residue on the surface helps control soil blowing and also maintains good tilth. Diversion terraces and grassed waterways may be needed to drain excess water in places. Irrigated crops respond to fertilizer. Irrigation systems designed and installed to account for the inherent soil limitations help control erosion. Capability units IIIe–4, dryland, and IIIe–2, irrigated; Mixedland range site.

Obaro loam, 3 to 5 percent slopes (OaC).—This gently sloping soil is on side slopes. It is lower on the landscape than Burson and Quinlan soils and higher than Sweetwater and Clairemont soils. The areas of this soil are about 20 acres to 200 acres in size. The slope is mainly about 4 percent.

The surface layer is reddish-brown loam about 20 inches thick. The next layer is red loam to a depth of 38 inches. The underlying material is weakly cemented sandstone to a depth of 60 inches.

Included with this soil in mapping are Quinlan, Dumas, and Dallam soils and areas where the slope is less than 3 percent.

This soil is used mainly for range. Some small areas are used for dryfarmed and irrigated crops, including wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is moderate. Small grains and sorghums combined with residue-conserving tillage, contour farming, and terracing help control soil blowing and maintain good tilth. Irrigated crops need fertilizer and a sprinkler system that regulates the irrigation water. Terraces are needed where cultivated crops are grown if crop residue is not kept on the surface throughout the year. Grassed waterways and diversion terraces are needed in places. Pastures need good management, including fertilization, frequent irrigation, and rotation grazing. Capability units IVe–3, dryland, and IVe–1, irrigated; Mixedland range site.

Obaro-Urban land complex, 3 to 12 percent slopes (ObD).—This complex consists of gently sloping to strongly sloping Obaro soils and Urban land. The areas of this complex are so intricately mixed or so small that they were not mapped separately. About 50 percent of this mapping unit is Obaro soils, 40 percent is Urban land, and 10 percent is Tascosa and Quinlan soils. Most of the acreage is within the cities of Borger, Fitch, and Stinnett and on industrial plant sites. The average slope is 8 percent.

Obaro soils have a surface layer of reddish-brown loam about 8 inches thick. The next layer is reddish-brown loam about 10 inches thick. Below that, to a depth of about 37 inches, is red loam that is 10 percent calcium carbonate. The underlying material is light-red, weakly cemented sandstone to a depth of 60 inches.

Urban land consists of areas taken up by industrial plants, railways, buildings, parking lots, streets, roads, and sidewalks. Much of the soil material has been altered by cuts and fills because of the slope.

The depth to bedrock, which affects septic tanks and sewage lagoons, and the soil slope can limit urban development and development of recreation areas. Not assigned to a capability unit or range site.

Obaro and Quinlan soils, rolling (OQE).—This mapping unit is on uplands. Its composition is more variable and the acreage generally is much larger than that of most other mapping units in the country. Mapping has been controlled well enough, however, for the anticipated uses of these soils.

Obaro loam makes up about 53 percent of this mapping unit, Quinlan loam about 41 percent, and other soils about 6 percent. Some areas have only the Obaro soil, some have the Quinlan soil, and others have both soils. Soil patterns are not uniform and occur without regularity. The Quinlan soil is mainly on higher ridges and the Obaro soil on side slopes. Areas range from a few acres to several hundred acres in size. The slope ranges from 3 to 20 percent.

This soil has the profile described as representative of the Obaro series.

This mapping unit is in range. Capability unit VIe–1, dryland; Mixedland range site.

Potter Series

The Potter series consists of very shallow, calcareous, loamy soils that are sloping to steep on uplands. These soils formed in beds of caliche material.

In a representative profile the surface layer is grayish-brown calcareous loam about 6 inches thick. The underlying material is 34 inches thick. In the upper 12 inches this layer is pinkish-white gravelly loam that is 50 percent hard caliche carbonate pebbles, and in the lower 22 inches it is white platy caliche that is about 70 percent caliche fragments and 30 percent weakly cemented and powdery caliche.

Potter soils are well drained. Permeability is moderate, and the available water capacity is very low. Runoff is medium to rapid.

These soils are used only for range.

Representative profile of Potter soils, 5 to 20 percent slopes, 1 mile north of the courthouse in Stinnett on Texas Highway 207, 100 feet on west side of road, in a pasture:

A1—0 to 6 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate, very fine, subangular blocky structure; hard, friable; many worm casts; common, indurated, caliche pebbles as much as 4 inches in diameter; calcareous; moderately alkaline; clear, wavy boundary.

C1ca—6 to 18 inches, pinkish-white (7.5YR 8/2) gravely loam, pinkish gray (7.5YR 6/2) moist; 50 percent hard pebbles of calcium carbonate and a few, flaggy, fractured caliche rocks.

C2ca—18 to 40 inches, white (10YR 8/2) platy caliche; 70 percent caliche fragments and about 30 percent weakly cemented and powdery caliche.

The A horizon ranges from 5 to 8 inches in thickness. It is grayish brown or brown gravelly loam or loam. The C1ca

horizon ranges from 7 to 12 inches in thickness. It is white or light brown, and its calcium carbonate content ranges from 40 to 60 percent. The C2ca horizon ranges from white to light gray. Its calcium carbonate content ranges from 60 to 80 percent.

The Potter soils generally occur along and below the cap, and most are in the thermic temperature zone. Some Potter soils have a temperature of less than 59° F and are outside the range described for the Potter series.

Potter soils, 5 to 20 percent slopes (PtE).—This sloping to steep soil is on convex ridges. It is lower on the landscape than Sunray, Conlen, and Gruver soils and higher than Berda and Mobeetie soils. Some areas are dominantly loam, and others are dominantly gravelly loam. Soil patterns are not uniform and occur without regularity. The areas of these soils are 20 acres to 300 acres in size. The slope is commonly about 10 percent.

This mapping unit is used for range and as wildlife habitat. Capability unit VIIs–1; Very Shallow range site.

Quinlan Series

The Quinlan series consists of shallow, calcareous, loamy soils that are rolling on uplands. These soils formed in material derived from calcareous, weakly consolidated sandstone.

In a representative profile the surface layer is reddish-brown loam about 6 inches thick. The next layer is red loam about 11 inches thick. The underlying material is light-red, weakly cemented, calcareous sandstone to a depth of 50 inches or more.

Quinlan soils are well drained. Permeability is moderately rapid, and the available water capacity is low. Runoff is medium to rapid.

These soils are used for range.

Quinlan soils are mapped as an undifferentiated unit with Obaro soils.

Representative profile of Quinlan loam, in an area of Obaro and Quinlan soils, rolling, 1,100 feet northeast of end of Hutchinson County airfield north of Borger, 250 feet south of road Y, in a pasture:

A—0 to 6 inches, reddish-brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) moist; weak subangular blocky structure; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

B2—6 to 17 inches, red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak subangular blocky structure; slightly hard, friable; few films and threads of calcium carbonate; few small fragments of soft sandstone; calcareous; moderately alkaline; clear, smooth boundary.

C—17 to 50 inches, light-red (2.5YR 6/6), weakly cemented sandstone, red (2.5YR 5/6) moist; calcareous; moderately alkaline.

The A horizon ranges from 5 to 7 inches in thickness. It is light reddish brown or reddish brown. The B horizon ranges from 7 to 11 inches in thickness. It is light red or red. The C horizon is red or light red and is at a depth of 12 to 19 inches. The sandstone is weakly cemented to strongly cemented.

Sherm Series

The Sherm series consists of deep, noncalcareous, loamy soils that are nearly level to gently sloping on uplands. These soils formed in eolian material.

In a representative profile the surface layer is brown neutral clay loam about 6 inches thick. The next layer is 74 inches thick. In the upper 14 inches this layer is brown clay, in the next 16 inches it is brown clay loam, in the 16 inches below that it is light-brown clay loam that is about 18 percent calcium carbonate by volume, in the next 18 inches it is pink clay loam that is about 32 percent calcium carbonate by volume, and in the lowermost 10 inches it is reddish-yellow clay loam that is about 12 percent calcium carbonate by volume.

Sherm soils are well drained. Permeability is very slow, and the available water capacity is high. Runoff is slow.

Most areas of these soils are used for crops, but a few areas are in native range.

Representative profile of Sherm clay loam, 0 to 1 percent slopes, 1.25 miles south and 0.6 mile west on Farm Road 1923 from junction with Farm Road 1590, on north side of road, in a field:

Ap—0 to 6 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak, very fine, granular structure; hard, friable; neutral; abrupt, smooth boundary.

B21t—6 to 12 inches, brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate, medium and fine, blocky structure; very hard, firm; few very fine pores; few worm casts; common clay films; mildly alkaline; clear, smooth boundary.

B22t—12 to 20 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate, medium, blocky structure; very hard, very firm; few very fine pores; common clay films; mainly noncalcareous, but the lower 2 inches is calcareous; moderately alkaline; clear, smooth boundary.

B23t—20 to 36 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak, medium and fine, blocky structure; hard, friable; few fine and very fine pores; few clay films; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—36 to 52 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak, medium and fine, subangular blocky structure; hard, friable; many medium to fine pores; common threads and films and a few soft masses of calcium carbonate, about 18 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

B25tca—52 to 70 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; weak, medium and fine, subangular blocky structure; hard, friable; few fine pores; few worm casts; common threads, films, soft masses, and concretions of calcium carbonate, about 32 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

B26tca—70 to 80 inches, reddish-yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; weak, medium and fine, subangular blocky structure; hard, friable; few fine pores; common threads and films of calcium carbonate, about 12 percent by volume; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Secondary soft lime is at a depth ranging from 15 to 25 inches. Distinct horizons of lime accumulation are at a depth of 30 to 60 inches. The A horizon is very dark grayish brown or brown. It ranges from 4 to 7 inches in thickness. The B21t horizon is dark brown or brown. It ranges from 5 to 8 inches in thickness. Clay content in the upper 20 inches of the Bt horizon ranges from 40 to 50 percent. The lower part of the Bt horizon is reddish brown, light brown, brown, pink, or reddish yellow.

Sherm clay loam, 0 to 1 percent slopes (ShA).—This nearly level soil is in broad areas. These areas are about 40 acres to several thousand acres in size.

This soil has the profile described as representative of the Sherm series.

Included with this soil in mapping are Dumas, Gruver, Ness, and Sunray soils.

This soil is used mainly for dryfarming and irrigated farming, but small areas are in range. The crops grown are wheat, corn, grain sorghum, and forage sorghum.

The hazard of soil blowing is slight. Management should include management of crop residue and timely but limited tillage to help control soil blowing. Diversion terraces and grassed waterways help drain excess water. Irrigated crops need fertilizers and a system that regulates the irrigation water. Recovery systems for runoff irrigation water frequently are useful. Capability units IIIe–5, dryland, and IIs–1, irrigated; Clay Loam range site.

Sherm clay loam, 1 to 3 percent slopes (ShB).—This gently sloping soil is in convex areas that range from about 15 acres to 150 acres in size. The slope is commonly about 2 percent.

The surface layer is brown clay loam about 4 inches thick. The next layer is brown clay about 15 inches thick. The layer below that is brown clay loam about 14 inches thick. And the next layer is light-brown clay loam about 32 inches thick. The underlying material is reddish-yellow clay loam to a depth of 80 inches.

Included with this soil in mapping are Conlen, Gruver, and Sunray soils. Also included are soils that have slopes of less than 1 percent.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is slight. Management should include keeping crop residue on the surface when crops are not being grown, timely but limited tilling, and rotating crops. Contour farming and terracing are needed to control erosion, except when crops are drilled and stubble is mulched where slopes are short. Diversion terraces and grassed waterways are needed in places. Irrigated crops need fertilizer and a system that regulates the irrigation water to maintain good tilth. Capability units IIIe–1 dryland, and IIIe–1, irrigated; Clay Loam range site.

Sunray Series

The Sunray series consists of deep, calcareous, loamy soils that are nearly level to gently sloping on uplands. These soils formed in eolian calcareous material.

In a representative profile the surface layer is dark grayish-brown clay loam about 10 inches thick. The next layer is clay loam to a depth of 80 inches. In the upper 12 inches this layer is reddish yellow, in the next 18 inches it is pink and is about 10 percent calcium carbonate, in the 12 inches below that it is reddish yellow and is about 7 percent calcium carbonate, and in the next 14 inches it is reddish yellow. In the lowermost 14 inches it is yellowish red.

Sunray soils are well drained. Permeability is moderate, and the available water capacity is medium. Runoff is slow to medium.

These soils are used for crops and range.

Representative profile of Sunray clay loam, 1 to 3 percent slopes, 5.5 miles west on Farm Road 281 from junction with Texas Highway 136, 0.2 mile north on county road, 500 feet west:

A1--0 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; coarse prismatic structure parting to moderate, very fine, subangular blocky; hard, friable; many roots; common worm casts; calcareous; moderately alkaline; clear, smooth boundary.

B21t—10 to 22 inches, reddish-yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate, coarse, prismatic structure parting to weak, subangular blocky; hard, friable; common roots; common worm casts; few clay films; common threads and films of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B22tca—22 to 40 inches, pink (7.5YR 7/4) clay loam, brown (7.5YR 5/4) moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard, friable; few fine roots; few pores; few worm casts; few clay films; common, fine and very fine, soft masses and concretions of calcium carbonate, about 10 percent by volume; calcareous; moderately alkaline; diffuse, smooth boundary.

B23tca—40 to 52 inches, reddish-yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; weak, fine, subangular blocky structure; hard, friable; common pores; few clay films; common films, threads, soft masses, and concretions of calcium carbonate, about 7 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

B24t—52 to 66 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate, fine, subangular blocky structure; hard, friable; few clay films; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B25t—66 to 80 inches, yellowish-red (5YR 5/8) clay loam, yellowish red (5YR 4/8) moist; moderate, medium, subangular blocky structure; hard, firm; few clay films; few films and threads of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. The A horizon is dark grayish brown, brown, or dark brown. It ranges from 8 to 14 inches in thickness. The B21t horizon is reddish yellow, light brown, pale brown, or brown. It ranges from 9 to 13 inches in thickness. The B22tca horizon is pink, light brown, or light reddish brown, and it ranges from 15 to 24 inches in thickness. Its calcium carbonate content ranges from 8 to 15 percent. The B23tca horizon is pink, reddish yellow, light brown, or light reddish brown. It ranges from 10 to 24 inches in thickness, and its calcium carbonate content ranges from 5 to 8 percent. The B24t horizon is strong brown, reddish yellow, red, or yellowish red and ranges from 12 to 18 inches in thickness. The B25t horizon is red, reddish yellow, strong brown, or yellowish red.

Sunray clay loam, 0 to 1 percent slopes (SuA).—This nearly level soil is on low, convex ridges. The areas of this soil are about 20 acres to 200 acres in size.

The surface layer is dark grayish-brown clay loam about 10 inches thick. The next layer is reddish-yellow clay loam about 13 inches thick. Below that, to a depth of 42 inches, is pink clay loam that is 12 percent calcium carbonate. The next layer is reddish-yellow clay loam that is about 12 inches thick and is 5 percent calcium carbonate. Below that, to a depth of 68 inches, is reddish-yellow clay loam. The next layer is yellowish-red clay loam to a depth of 80 inches.

Included with this soil in mapping are Sherm, Conlen, Dumas, Gruver, and Ness soils.

This soil is used for range and for dryfarming and irrigated farming. The main crops grown are wheat,

corn, grain sorghum, and forage sorghum, but some alfalfa and vegetables are also grown.

The hazard of soil blowing is moderate. Keeping crop residue on the surface helps control soil blowing and erosion and also maintains good tilth. Diversion terraces and grassed waterways are needed in places. Irrigated crops need fertilizer and a system that regulates the irrigation water to maintain good tilth. Capability units IIIe–6, dryland, and IIe–1, irrigated; Hardland Slopes range site.

Sunray clay loam, 1 to 3 percent slopes (SuB).—This gently sloping soil is in convex areas that range from about 15 acres to 250 acres in size. The slope is commonly about 2 percent.

This soil has the profile described as representative of the Sunray series.

Included with this soil in mapping are Conlen, Gruver, and Dumas soils and Sunray soils that have slopes of less than 1 percent.

This soil is used for range and for dryfarming and irrigated farming. The crops grown are wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is moderate. Good management includes keeping crop residue on the surface when crops are not being grown, timely but limited tilling, and rotating crops. Contour farming and terracing are needed to control erosion, except when crops are drilled and stubble is mulched in places where slopes are short. Diversion terraces and grassed waterways are needed in places. Irrigated crops need fertilizer and a system that regulates the irrigation water to maintain good tilth. Capability units IIIe–2, dryland, and IIIe–2, irrigated; Hardland Slopes range site.

Sweetwater Series

The Sweetwater series consists of deep, calcareous, loamy soils on flood plains and foot slopes. These soils are nearly level and formed in alluvial or colluvial material.

In a representative profile the surface layer is dark-gray silty clay loam about 11 inches thick. The next layer is light brownish-gray silty clay loam that has strong-brown mottles and is about 5 inches thick. The underlying material is very pale brown stratified loamy sand to a depth of 60 inches or more.

Sweetwater soils are poorly drained. Permeability is moderately slow, and the available water capacity is medium. Runoff is slow. The water table is at a depth of about 1 to 2 feet.

Most areas of these soils are in meadows and range.

Representative profile of Sweetwater soils, 0.3 mile northwest of the north end of a pipeline across Canadian River, 16 miles northeast of Stinnett on Turkey Track Ranch:

A11—0 to 11 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate, fine, granular structure; very hard, firm; many roots; calcareous; moderately alkaline; clear, smooth boundary.

A12—11 to 16 inches, light brownish-gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, blocky structure; very hard, firm; common roots; calcareous; moderately alkaline; clear, smooth, boundary.

C—16 to 60 inches, very pale brown (10YR 7/3) loamy sand, pale brown (10YR 6/3) moist; common, yellowish-brown mottles; massive; slightly hard, friable; few strata of grayish-brown, finer textured material; calcareous; moderately alkaline.

The A11 horizon ranges from 10 to 12 inches in thickness. It is gray, very dark gray, or dark gray. It ranges from sandy clay loam to silty clay loam. The A12 horizon ranges from 5 to 12 inches in thickness. It is light brownish gray, grayish brown, or gray. It ranges from silty clay loam to loam. The C horizon is brown, light brown, or very pale brown. It ranges from loamy fine sand to fine sand.

Sweetwater soils (Sw).—This nearly level mapping unit is on flood plains. Some areas are dominantly silty clay loam, and others are dominantly sandy clay loam or clay loam. Soil patterns are not uniform and occur without regularity. The areas of this soil are 20 to 500 acres in size. Occasional flooding occurs once every 1 to 5 years. The water table is within 1 to 2 feet of the surface.

Included with this mapping unit in mapping are Yahola, Lincoln, and Likes soils.

The hazard of soil blowing is slight.

This mapping unit is used mainly for meadows and range. Capability unit Vw–2, dryland; Loamy Bottomland range site.

Tascosa Series

The Tascosa series consists of deep, calcareous, gravelly loamy soils that are gently sloping to moderately steep on uplands. These soils formed in stratified outwash beds of sand and gravel.

In a representative profile the surface layer is brown gravelly loam about 8 inches thick. It is 30 to 40 percent rounded quartz gravel, and some of the gravel is coated with calcium carbonate. The next layer is pinkish-gray very gravelly loam about 6 inches thick. It is 55 percent rounded quartz gravel, and the gravel is coated with calcium carbonate. The underlying material is 46 inches or more thick. In the upper 8 inches this layer is pinkish-gray very gravelly loam that is 55 percent rounded quartz gravel and 45 percent calcium carbonate. In the lower 38 inches it is pink very gravelly sandy loam that is 55 percent quartz gravel.

Tascosa soils are well drained. Permeability is moderate, and the available water capacity is low. Runoff is rapid.

Most areas of these soils are in range.

Representative profile of Tascosa gravelly loam, 3 to 20 percent slopes, 0.7 mile north of Sanford Dam on Farm Road 687, 2.7 miles west on paved and unpaved roads, 0.3 mile northwest on unpaved road, in a pasture:

A1—0 to 8 inches, brown (7.5YR 5/2) gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky and granular structure; slightly hard, very friable; many fine roots; rounded quartzite pebbles about 30 to 40 percent by volume; 40 to 60 percent of surface covered with pebbles; carbonates on lower side of some pebbles; calcareous; moderately alkaline; clear, smooth boundary.

Bca—8 to 14 inches, pinkish-gray (7.5YR 6/2) very gravelly loam, brown (7.5YR 4/2) moist; weak, fine, granular structure; loose, very friable; common roots; pebbles coated with calcium carbonate on lower side; films, threads, and calcium carbonate coatings on the quartzite pebbles, about 15 percent by volume; other carbonates about 6 percent by vol-

ume; rounded quartzite pebbles make up an estimated 55 percent; calcareous; moderately alkaline; clear, smooth boundary.

Cca—14 to 22 inches, pinkish-gray (7.5YR 6/2) very gravelly loam, brown (7.5YR 4/2) moist; massive; slightly hard, very friable; few roots; calcium carbonate, less than 2 to 3 millimeters, about 45 percent by volume; pebbles coated with calcium carbonate; rounded quartzite pebbles, about 55 percent by volume; calcareous; moderately alkaline; gradual, smooth boundary.

C—22 to 60 inches, pink (7.5YR 7/4) very gravelly sandy loam, reddish yellow (7.5YR 6/6) moist; massive; loose, very friable; calcium carbonate, about 8 percent by volume; quartzite pebbles, about 55 percent by volume; calcareous; moderately alkaline.

Depth to the Cca horizon ranges from 13 to 18 inches. The A1 horizon ranges from 8 to 10 inches in thickness. It is brown or dark grayish brown. Gravel content in this horizon ranges from 30 to 40 percent. The Bca horizon ranges from 5 to 8 inches in thickness. It is pale brown, pinkish gray, or brown. Gravel content ranges from 45 to 60 percent, and calcium carbonate ranges from 12 to 20 percent. Cca horizon ranges from 7 to 12 inches in thickness. It is pinkish gray or very pale brown. Gravel content ranges from 30 to 50 percent, and calcium carbonate content ranges from 20 to 40 percent. The C horizon is pink or very pale brown. Gravel content ranges from 10 to 20 percent.

Tascosa soils are in the Canadian River breaks and are within an area in the mesic-thermic line. Some Tascosa soils have a temperature of more than 50° F and are outside the range described for the Tascosa series.

Tascosa gravelly loam, 3 to 20 percent slopes (TaE).—This gently sloping to moderately steep soil is on convex ridges. The areas of this soil are about 20 to 500 acres in size. The slope is commonly about 12 percent.

Included with this soil in mapping are Likes, Dumas, Mobeetie, Dallam, and Veal soils.

This soil is mainly in range. Areas that have a high content of gravel are used for gravel pits. Capability unit VIs–1, dryland; Gravelly range site.

Tivoli Series

The Tivoli series consists of deep, noncalcareous, sandy soils that are gently sloping and rolling on uplands. These soils formed in sandy eolian material. They are in areas marked by dunes and hummocks.

In a representative profile the surface layer is brown fine sand about 4 inches thick. The underlying material is fine sand about 80 inches or more thick. In the upper 48 inches this layer is very pale brown and loose, and in the lower 32 inches it is light brown.

Tivoli soils are excessively drained. Permeability is rapid, and the available water capacity is low. Runoff is very slow.

Most areas of these soils are used for range.

Representative profile of Tivoli fine sand, 4.25 miles east of Stinnett railroad crossing on Farm Road 1526, 200 feet south, in a pasture:

A1—0 to 4 inches, brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; weak, granular structure; loose; neutral; gradual, smooth boundary.

C1—4 to 52 inches, very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grained; loose; neutral; gradual, smooth boundary.

C2—52 to 84 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; calcareous; moderately alkaline.

The A horizon ranges from 4 to 7 inches in thickness. It is brown or pale brown. The C1 horizon ranges from 24 to 75 inches in thickness. It is very pale brown to light yellowish brown.

Tivoli fine sand (Tv).—This gently sloping and rolling soil is in hummocky areas. It is higher on the landscape than Likes soils and lower than Veal and Potter soils. The areas of this soil are longer than wide. They average about 400 acres, but range from 40 acres to more than 1,000 acres in size. The slope is mainly about 7 percent but ranges from 3 to 12 percent.

Included with this soil in mapping are Likes and Mobeetie soils, which occur at the edges of mapped areas. Also included are a few small areas of blowouts (fig. 5).

The hazard of soil blowing is severe .

This soil is used for range. Capability unit VIIe–1; Deep Sand range site.

Urban Land

Urban land consists of cuts and fills that are 30 inches or more thick. It is mainly in and around cities or industrial areas. The original soil profile is no longer identifiable. The landscape has been modified, and in leveled areas cuts and fills are as much as 30 feet deep. Leveled lots to be used for houses are not considered Urban land unless slope is more than 5 percent over an extensive area where a succession of lots have to be cut and filled. Such areas have retainer walls, 3 to 8 feet high, on one or more sides of the lots. Most areas range from 20 to about 250 acres in size.

Urban land consists of areas taken up by industrial plants, buildings, parking lots, roads, streets, railroads, and sidewalks.

Urban development can be limited where steel pipelines would fail because of soil corrosivity, where sewage lagoons would fail because of permeability, and where stabilizing cut areas would be difficult.

Urban land is mapped only in complexes with Dallam, Obaro, and Veal soils.

Veal Series

The Veal series consists of deep, calcareous loamy soils that are gently sloping and rolling on uplands. These soils formed in calcareous loamy material derived from old alluvium.

In a representative profile the surface layer is brown fine sandy loam about 6 inches thick. The next layer is sandy clay loam about 28 inches thick. In the upper 9 inches this layer is grayish brown, and in the lower 19 inches it is pink and is about 45 percent calcium carbonate. The underlying material is 46 inches or more thick. In the upper 32 inches this layer is pink sandy clay loam that is about 22 percent calcium carbonate, and in the lower 14 inches it is light-brown fine sandy loam.

Veal soils are well drained. Permeability is moderate, and the available water capacity is medium. Runoff is medium.

These soils are used for crops and range.

Representative profile of Veal fine sandy loam, 3 to 5 percent slopes, 2.9 miles east of Stinnett railroad, cross-

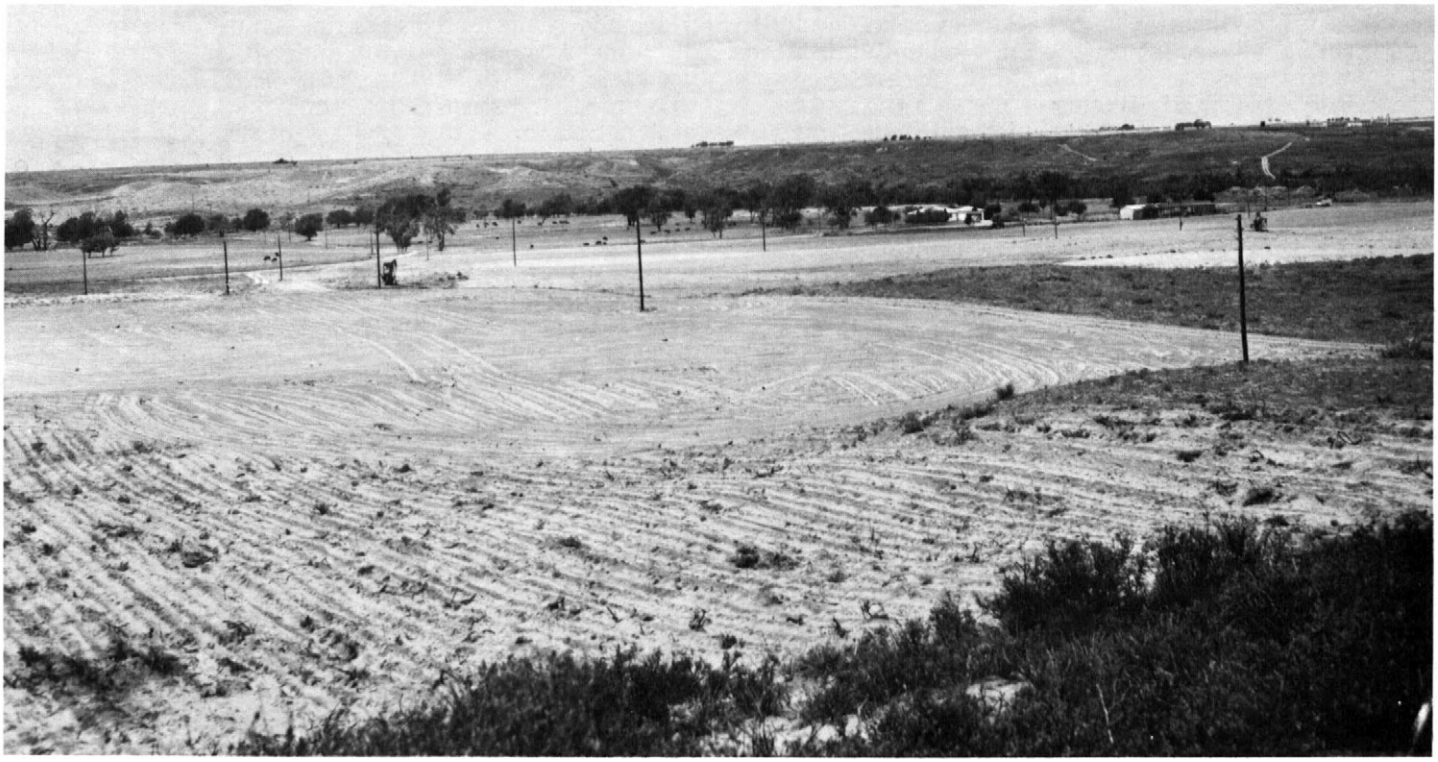


Figure 5.—**Active area of soil blowing that has been shaped and reseeded. The soil is Tivoli fine sand.**

ing on Farm Road 1526 and county road, 400 feet north, in a pasture:

A1—0 to 6 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate, fine and very fine, subangular blocky structure; hard, friable; many fine pores; many worm casts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B2—6 to 15 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate, fine and very fine, subangular blocky structure; hard, friable; many fine pores; few films, threads, and fine concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B2ca—15 to 34 inches, pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; weak subangular blocky structure; hard, friable; few fine pores; many films, threads, soft masses, and concretions of calcium carbonate, about 45 percent by volume; calcareous; moderately alkaline; diffuse, smooth boundary.

Cca—34 to 66 inches, pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) moist; massive; hard, friable; few fine pores; common to many films, threads, and concretions of calcium carbonate, about 22 percent by volume; calcareous; moderately alkaline; clear, smooth boundary.

C—66 to 80 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; massive; hard, friable; few fine films, threads, and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 to 40 inches in thickness. The A horizon is grayish brown or brown and ranges from 5 to 7 inches in thickness. The B2 horizon is pale-brown, light-brown, grayish-brown, or brown sandy clay loam to clay loam. It ranges from 8 to 13 inches in thickness and its calcium carbonate content is 3 to 10 percent. The B2ca horizon is pink, pinkish-gray, light reddish-brown, or pale-brown sandy clay loam to clay loam. It ranges from 16 to 20 inches in thickness, and its calcium carbonate content is 40 to 50 percent. The Cca horizon is pink or light yellowish-brown sandy clay loam or fine sandy loam. It ranges from 22 to 33 inches in thickness and its calcium carbonate content is 10 to 25 percent. The C horizon is light-brown or brown sandy clay loam to fine sandy loam.

Veal fine sandy loam, 1 to 3 percent slopes (VeB).—This gently sloping soil is on convex ridges. The areas of this soil are about 20 acres to 200 acres in size. The slope is mainly about 2 percent.

The surface layer is brown fine sandy loam about 7 inches thick. The next layer is pale-brown sandy clay loam about 9 inches thick. Below this, to a depth of 35 inches, is pinkish-gray sandy clay loam that is 45 percent calcium carbonate by volume. The next layer is pink sandy clay loam about 33 inches thick and is 10 percent calcium carbonate by volume. The underlying material is light-brown fine sandy loam to a depth of 80 inches.

Included with this soil in mapping are Berda, Dallam, Dumas, Potter, and Mobeetie soils.

This soil is used for range and for dryfarming and irrigated farming. The main crops grown are wheat, grain sorghum, and forage sorghum, but some alfalfa is grown.

The hazard of soil blowing is moderate, and this soil needs management that helps reduce soil blowing. Small grain and sorghums combined with residue-conserving tilling helps control soil blowing and maintain the soil. Diversion terraces and grassed waterways may be needed to drain excess water in places. Irrigated crops

respond to fertilization. Irrigation systems designed and installed to account for the inherent soil limitations help control erosion. Capability units IVe–2, dryland, and IIIe–4, irrigated; Mixedland Slopes range site.

Veal fine sandy loam, 3 to 5 percent slopes (VeC).—This gently sloping soil is on convex ridges and sideslopes. The areas of this soil are about 20 acres to 200 acres in size. The slope is mainly about 4 percent.

This soil has the profile described as representative of the Veal series.

Included with this soil in mapping are Berda, Dallam, Dumas, Potter, and Mobeetie soils.

This soil is used mainly for range. Some small areas are used for dryland and irrigated crops, including wheat, grain sorghum, and forage sorghum.

The hazard of soil blowing is moderate. Small grains and sorghums combined with residue-conserving tillage, contour farming, and terracing help control soil blowing and maintain good tilth. Irrigated crops need fertilizer and a sprinkler system that regulates the irrigation water. Terraces are needed where cultivated crops are grown if crop residue is not kept on the surface throughout the year. Grassed waterways and diversion terraces are needed in some places. Pastures need good management, including fertilization, frequent irrigation, and rotation grazing. Capability units IVe–4, dryland, and IVe–2, irrigated; Mixedland Slopes range site.

Veal-Urban land complex, 1 to 5 percent slopes (VuC).—This complex consists of gently sloping Veal soils and Urban land. The areas are so intricately mixed or so small that they were not mapped separately. About 50 percent of this mapping unit is Veal soils, 45 percent is Urban land, and 5 percent is Mobeetie and Potter soils. Most of the acreage is within the city of Borger and in industrial sites west of Borger. The areas of this complex are 12 acres to 270 acres in size. The average slope is 3 percent.

Veal soils have a surface layer of brown fine sandy loam about 6 inches thick. The next layer is grayish-brown sandy clay loam about 9 inches thick. Below that, to a depth of 34 inches, is pink sandy clay loam that is 45 percent calcium carbonate. The next layer is pink sandy clay loam about 32 inches thick that is 20 percent calcium carbonate. The underlying material is light-brown fine sandy loam to a depth of 80 inches.

Urban land consists of areas taken up by industrial plants, buildings, parking lots, streets, roads, railways, and sidewalks. Much of the soil material has been altered by cuts and fills because of the gently sloping terrain.

Urban development can be limited where steel pipelines would fail because of corrosivity, sewage lagoons would fail because of permeability, and stabilizing cut and fill areas would be difficult. Not assigned to a capability unit or range site.

Yahola Series

The Yahola series consists of deep, calcareous, loamy, alluvial soils that are nearly level on broad flood plains. These soils formed in loamy, calcareous, alluvial material.

In a representative profile the surface layer is grayish-brown fine sandy loam about 12 inches thick. The underlying material is fine sandy loam to a depth of 63 inches or more. In the upper 8 inches this layer is brown and stratified, in the 16 inches below that it is pale brown and stratified, in the next 22 inches it is pale brown, and in the lowermost 5 inches it is pale brown and has a few strong-brown mottles.

Yahola soils are well drained. Permeability is moderately rapid, and the available water capacity is medium. Runoff is slow.

Most areas of these soils are in range, but a few areas are farmed.

Representative profile of Yahola fine sandy loam, 15 miles east of Borger, 7 miles north on White Deer Creek, about 1,000 feet east-southeast of range headquarters:

A1—0 to 12 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, very fine, subangular blocky structure; slightly hard, very friable; common roots; common worm casts; few thin strata of finer textured material; calcareous; moderately alkaline; clear, smooth boundary.

C1—12 to 20 inches, brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; common roots; thin strata of loamy sand, silt loam, and clay loam; few worm casts; calcareous; moderately alkaline; clear, smooth boundary.

C2—20 to 36 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; hard, friable; common pores; few films and threads of calcium carbonate; thin strata of loamy and silty material; calcareous; moderately alkaline; clear, smooth boundary.

C3—36 to 58 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C4—58 to 63 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; few fine, strong-brown (7.5YR 5/6) mottles; calcareous; moderately alkaline.

The A horizon ranges from 9 to 12 inches in thickness. It is grayish brown or brown. The C1 horizon ranges from 8 to 11 inches in thickness. It is brown or light yellowish-brown fine sandy loam to loam. The C2 horizon ranges from 14 to 17 inches in thickness. It is brown or pale brown. The C3 horizon ranges from 14 to 26 inches in thickness. It is brown or pale-brown loam to loamy fine sand. The C4 horizon is pale-brown, brown, or very pale brown fine sandy loam to loamy sand.

Yahola fine sandy loam (Ya).—This nearly level soil is on flood plains and in channels. It is higher on the landscape than Sweetwater soils and lower than Mobeetie and Likes soils. The areas of this soil are 15 acres to 150 acres in size. Occasional flooding occurs once each 1 to 5 years. The slope is 0 to 1 percent.

Included with this soil in mapping are Veal, Mobeetie, Berda, Likes, and Lincoln soils.

This soil is used mainly for range. A small acreage is dryfarmed or irrigated for farming. The crops grown include wheat, grain sorghum, and forage sorghum. Floodwaters cover this soil after a heavy rain, but the damage is small because the flooding is brief.

The hazard of soil blowing is slight. Good management includes keeping crop residue on the surface when crops are not being grown, timely but limited tilling, and rotating crops. Diversion terraces and grassed waterways are needed in places. Irrigated crops need

fertilization, management of residue, rotation of crops, timely but limited tillage, and a system that regulates the irrigation water to maintain good tilth. Capability units IIIe–3, dryland, and IIe–2, irrigated; Loamy Bottomland range site.

Use and Management of Soils

The system of capability classification used by the Soil Conservation Service is briefly described in this section. Suggested management principles for dryland and irrigated capability units in Hutchinson County are given in the section "Descriptions of the Soils." Yield predictions for major crops and facts about the use of soils for range, wildlife habitat, recreation, and engineering are also presented.

Capability Grouping

Those who farm on a large scale may find similar methods to use and manage some of the different kinds of soil on their farm. They can make good use of the capability classification system. This grouping shows, in a general way, the suitability of soils for most kinds of crops.

The grouping is based on permanent limitations of the soils when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In Class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclass indicates major kinds of limitations within the classes. The subclasses are indicated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by articificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* indicates that the chief limitation is climate that is too cold, or too dry. (No *c* subclasses are in Hutchinson County.)

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only subclasses *w, s,* and *c,* because the soils are subject to little or no erosion but have other limitations that confine their use largely to pasture, range, or wildlife.

Subclasses are further divided into groups called capability units. These are groups of soils that are so much alike that they are suited to the same crops and pasture plants, they require about the same management, and they have generally similar productivity and other response to management. Capability units are generally identified by numbers assigned locally, for example, IIe–1 or IIIe–4.

The eight classes in the capability system and the subclasses and units in Hutchinson County are described in the list that follows. The unit designation is given in the Guide to Mapping Units.

Class I soils have few limitations that restrict their use (none in this county).

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

- Subclass IIe soils are subject to moderate erosion unless protected.
  - Unit IIe–1, dryland.—Deep, nearly level, moderately permeable, calcareous clay loams.
  - Unit IIe–1, irrigated.—Deep, nearly level, moderately permeable to moderately slowly permeable, calcareous to noncalcareous loams to clay loams.
  - Unit IIe–2, irrigated.—Deep, nearly level, moderately permeable to moderately rapidly permeable, calcareous to noncalcareous fine sandy loams.
- Subclass IIs soils are moderately limited because of slow permeability.
  - Unit IIs–1, irrigated.—Deep, nearly level, very slowly permeable, noncalcareous clay loams.
- Subclass IIw soils are moderately limited because of excess water.
  - Unit IIw–1, dryland and irrigated.—Deep, nearly level, moderately permeable, calcareous silt loams.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

- Subclass IIIe soils are subject to severe erosion if they are cultivated and not protected.
  - Unit IIIe–1, dryland and irrigated.—Deep, gently sloping, very slowly permeable, noncalcareous clay loams.
  - Unit IIIe–2, dryland.—Deep, gently sloping, moderately permeable to moderately slowly permeable, calcareous to noncalcareous loams to clay loams.
  - Unit IIIe–2, irrigated.—Deep to moderately deep, gently sloping, moderately permeable to moderately slowly permeable, calcareous

to noncalcareous loams to clay loams.

Unit IIIe–3, dryland.—Deep, nearly level to gently sloping, moderately rapidly permeable to moderately permeable, calcareous to noncalcareous fine sandy loams.

Unit IIIe–3, irrigated.—Deep, gently sloping, moderately permeable to moderately rapidly permeable, calcareous to noncalcareous fine sandy loams.

Unit IIIe–4, dryland.—Deep to moderately deep, gently sloping, moderately permeable, calcareous loams.

Unit IIIe–4, irrigated.—Deep, nearly level to gently sloping, moderately permeable, calcareous loams to fine sandy loams.

Unit IIIe–5, dryland.—Deep, nearly level, very slowly permeable, noncalcareous clay loams.

Unit IIIe–6, dryland.—Deep, nearly level, moderately permeable to moderately slowly permeable, calcareous to noncalcareous loams to clay loams.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Subclass IVe soils are subject to very severe erosion if they are cultivated and not protected.

Unit IVe–1, dryland.—Deep, gently sloping, moderately rapidly permeable, calcareous fine sandy loams.

Unit IVe–1, irrigated.—Deep to moderately deep, gently sloping, moderately permeable to moderately rapidly permeable, calcareous to noncalcareous loams to fine sandy loams.

Unit IVe–2, dryland.—Deep, nearly level to gently sloping, moderately permeable, calcareous loams to fine sandy loams.

Unit IVe–2, irrigated.—Deep, gently sloping, moderately permeable, calcareous loams to fine sandy loams.

Unit IVe–3, dryland.—Deep to moderately deep, gently sloping, moderately permeable to moderately rapidly permeable, calcareous to noncalcareous loams to fine sandy loams.

Unit IVe–4, dryland.—Deep, gently sloping, moderately permeable, calcareous loams to fine sandy loams.

Subclass IVs soils are very severely limited because of very slow permeability and tilth.

Unit IVs–1, dryland.—Deep, nearly level, very slowly permeable, noncalcareous clay.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat.

Subclass Vw soils are too wet for cultivation; drainage or protection not feasible.

Unit Vw–1, dryland.—Deep, nearly level, moderately permeable to rapidly permeable, calcareous clay loams to loamy fine sands.

Unit Vw–2, dryland.—Deep, nearly level, moderately slowly permeable, calcareous silty clay loams.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland or wildlife habitat.

Subclass VIe soils are severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIe–1, dryland.—Deep to shallow, gently sloping to sloping and rolling, moderately permeable to moderately rapidly permeable, calcareous loams, fine sandy loams to loamy fine sands.

Unit VIe–2, dryland.—Deep, gently sloping to moderately steep, moderately rapidly permeable, calcareous fine sandy loams.

Subclass VIs soils are severely limited because of gravel and slopes.

Unit VIs–1, dryland.—Deep, gently sloping to moderately steep, moderately permeable, calcareous gravelly loams.

Subclass VIw soils are severely limited because of excess water.

Unit VIw–1, dryland.—Deep, nearly level, very slowly permeable, noncalcareous clays.

Class VII soils have very severe limitations that make them unsuited to cultivation and restrict their use largely to range, woodland, or supplying wildlife food and cover.

Subclass VIIe soils are very severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIIe–1, dryland.—Deep, gently sloping and rolling, rapidly permeable, noncalcareous fine sands.

Subclass VIIs soils are very severely limited because of soil depth, stones, or slopes.

Unit VIIs–1, dryland.—Very shallow to deep, sloping to steep, moderately permeable, calcareous loams and caliche outcrops.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes (none in this county).

Predicted Yields

Table 2 lists predicted yields of the principal crops grown in the county. The predictions are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the county and on information taken from research data. The predicted yields are the average per acre yields that can be expected by commercial farmers at the level of management producing the highest economic returns.

The yields are given for both dryfarming and irrigated farming if the soils are used for both methods of farming. If only one method is practical, yields for only that method are given. Not included in this table are soils that are not used for crops or are used only for range or recreation.

Crops other than those shown in table 2 are grown in the county. Their predicted yields are not given be-

TABLE 2.—*Predicted average yields per acre of principal crops*

[Dashes indicate that the soil is not ordinarily used for the crop or that the crop is not grown under the management specified]

Soil	Dryfarming		Irrigated farming	
	Wheat	Grain sorghum	Wheat	Grain sorghum
	Bushels	*Pounds*	*Bushels*	*Pounds*
Berda loam, 1 to 3 percent slopes	15	1,500	55	6,000
Berda loam, 3 to 5 percent slopes	10	1,000		
Conlen loam, 0 to 1 percent slopes	10	900	40	4,500
Conlen loam, 1 to 3 percent slopes	10	900	35	4,000
Conlen loam, 3 to 5 percent slopes	10	900		
Dallam fine sandy loam, 0 to 1 percent slopes	10	1,000	60	6,500
Dallam fine sandy loam, 1 to 3 percent slopes	10	1,000	55	6,000
Dumas loam, 0 to 1 percent slopes	20	1,500	65	7,000
Dumas loam, 1 to 3 percent slopes	15	1,250	55	6,500
Dumas clay loam, 0 to 1 percent slopes	20	1,500	70	7,500
Gruver clay loam, 0 to 1 percent slopes	20	1,500	70	7,500
Gruver clay loam, 1 to 3 percent slopes	15	1,250	55	6,500
Humbarger clay loam	20	1,500	70	7,500
Mobeetie fine sandy loam, 1 to 3 percent slopes	15	1,250	45	5,000
Mobeetie fine sandy loam, 3 to 5 percent slopes	10	900		
Obaro loam, 1 to 3 percent slopes	15	1,500	55	6,000
Sherm clay loam, 0 to 1 percent slopes	15	1,000	70	7,500
Sherm clay loam, 1 to 3 percent slopes	10	800	65	7,000
Sunray clay loam, 0 to 1 percent slopes	15	1,500	65	7,000
Sunray clay loam, 1 to 3 percent slopes	15	1,000	55	6,000
Veal fine sandy loam, 1 to 3 percent slopes	10	1,000	35	4,000
Veal fine sandy loam, 3 to 5 percent slopes	10	1,000		

cause the acreage is small or reliable data on yields are not available.

The predicted yields for dryfarming given in table 2 can be expected if the following management practices are used:

1. Rainfall is effectively used and conserved.
2. Surface or subsurface drainage systems are installed.
3. Crop residue is managed to maintain good tilth.
4. Minimum but timely tillage is used.
5. Insect, disease, and weed control measures are consistently used.
6. Fertilizer is applied according to soil tests and needs of crops.
7. Adapted crop varieties are used at recommended rates of seeding.

For irrigated farming, these additional practices are used:

8. Suitable quality of irrigation water is used.
9. Irrigation is timed to meet the need of the soil and crop.
10. Irrigation systems are properly designed and efficiently used.

Range [2]

Ranching and livestock farming are important enterprises in Hutchinson County. About 433,591 acres, or 74 percent of the county, is in native grass. There are about 50 ranches in the county. They range from 700 to 44,000 acres in size, and the average is about 5,000 acres. The average rainfall is 20.7 inches.

Crops are grown on 90 percent of the ranches. These crops are mainly grazing or hay crops that include grain sorghum, small grains, and hybrid sorghums. Several thousand head of stocker cattle are brought in annually to graze wheat fields, but most livestock operations are cow-calf enterprises. Most of the stocker cattle are finished in local feedlots or sent to feedlots in adjoining counties. Mainly corn silage and milo grain are fed to cattle in local feedlots.

Most of the ranches are located in the southern three-quarters of the county and part of the northwest corner. There are several kinds of grass in the county. Tall grasses grow mainly in the sandy central and eastern part of the county. Short grasses grow mainly in the northwest corner of the county, which is more clayey or is hardlands. Only sparse vegetation grows in the southwest corner of the county, which is steep and rough.

Range sites and condition classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. The soils that produce about the same kinds and amount of forage make up a range site.

Range sites are kinds of range that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community. It reproduces itself and does not change so long as the environment remains the same. Currently

[2] By JOHN WRIGHT, range conservationist, Soil Conservation Service, Amarillo.

the climax vegetation throughout the prairie and the plains consists of the plants that were growing when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease under close grazing. They generally are the tallest and most productive perennial grasses and forbs, and they are the most palatable to livestock.

Increasers are plants in the climax vegetation that increase as the most desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the quality of the vegetation after grazing or other uses. The classes show the present condition of the native vegetation compared to that of the potential vegetation that could grow there.

A range is in *excellent* condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in *good* condition if the percentage is 51 to 75, in *fair* condition if it is 26 to 50, and in *poor* condition if it is less than 25.

The potential production of forage depends on the range site. Current forage production depends on the range condition and the moisture available to plants during the growing season.

A primary objective of good management is to keep the range in excellent or good condition. This conserves water, improves yields, and protects the soils. Important changes in the kind of cover on a range site take place gradually, and they can be misinterpreted or overlooked. Growth encouraged by heavy rainfall can obscure the condition of the range, although the cover can be weedy and the long-term trend is lower production. But some range that is under the supervision of a careful manager, and that has been closely grazed for short periods can have an appearance that temporarily conceals its quality and ability to recover.

Descriptions of range sites

In the following pages, the range sites of Hutchinson County are described and the climax and invader plants are named. An estimate of the potential annual yield of air-dry herbage when a site is in excellent condition is also given. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

CLAY LOAM RANGE SITE

This site is nearly level to gently sloping. The soils are loamy, deep, and moderately permeable to very slowly permeable.

The climax plant community is a mixture of short and mid grasses and forbs. About 50 percent, by weight, of the plant community consists of blue grama; 5 percent, vine mesquite; 10 percent, western wheatgrass; 5 percent, sideoats grama; 15 percent, buffalograss; 5 percent, silver bluestem; 5 percent, plains actinea; and 5 percent, annual forbs.

Deteriorated range can be recovered by reseeding to desirable grasses followed by deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,300 to 2,200 pounds per acre in years of favorable rainfall. About 90 percent of this vegetation is forage for livestock and wildlife.

DEEP SAND RANGE SITE

This site is gently sloping and rolling dunes. The soils are sandy, deep, and rapidly permeable.

The climax plant community is a mixture of tall and mid grasses and forbs. About 10 percent, by weight, of the plant community consists of little bluestem; 10 percent, annual forbs; 10 percent, sand bluestem; 10 percent, switchgrass; 10 percent, shin oak; 5 percent, indiangrass; 5 percent, sand lovegrass; 5 percent, sideoats grama; 5 percent, silver bluestem; 5 percent, three-awn; 5 percent, big sandreed; 5 percent, sand dropseed; 5 percent, sandplum; 5 percent, skunkbush sumac; and 5 percent, annual grasses.

Under heavy grazing the plant cover deteriorates rapidly, but it responds to good grazing management. Deteriorated range can be recovered by reseeding or by controlling brush followed by deferred grazing (fig. 6).

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 to 2,000 pounds per acre in years of favorable rainfall. About 75 percent of this vegetation is forage for livestock and wildlife.

GRAVELLY RANGE SITE

This site is gently sloping to moderately steep. The soils are gravelly loamy, deep, and moderately permeable. The mulch that covers the hills and knobs is gravelly and cobbly and resists erosion. It helps to conserve moisture and prevent plants from crowding each other.

The climax plant community is a mixture of tall and mid grasses and forbs. About 40 percent, by weight, of the plant community consists of sideoats grama; 10 percent, little bluestem; 5 percent, sand bluestem; 10 percent, blue grama; 5 percent, hairy grama; 15 percent, black grama; 5 percent, catclaw acacia; 5 percent, perennial forbs; and 5 percent, other woody plants.

Deteriorated range can be recovered by deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,000 to 1,700 pounds per acre in years of favorable rainfall. About 70 percent of this vegetation is forage for livestock and wildlife.

Figure 6.—**An area of the Deep Sand range site that needs reseeding and deferred grazing. The soil is Tivoli fine sand.**

HARDLAND SLOPES RANGE SITE

This site is nearly level to sloping and rolling. The soils are loamy, deep, and moderately permeable.

The climax plant community is a mixture of tall and mid grasses and forbs. About 40 percent, by weight, of the plant community consists of sideoats grama; 15 percent, little bluestem; 20 percent, blue grama; 5 percent, buffalograss; 5 percent, three-awns; 5 percent, sand dropseed; 5 percent, annual grasses; and 5 percent, annual forbs.

Deteriorated range can be recovered by reseeding and deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,300 to 2,200 pounds per acre in years of favorable rainfall. About 80 percent of this vegetation is forage for livestock and wildlife.

LOAMY BOTTOMLAND RANGE SITE

This site is on nearly level flood plains along streams. It receives runoff from adjacent, more sloping soils, and it is subject to flooding and sediment deposition in places. The soils are loamy and are moderately slowly permeable to moderately rapidly permeable.

The climax plant community is a mixture of tall and mid grasses and forbs. About 20 percent, by weight, of the plant community consists of switchgrass; 15 percent, indiangrass; 10 percent, western wheatgrass; 10 percent, little bluestem; 10 percent, sideoats grama; 5 percent, alkali sacaton; 5 percent, tall dropseed; 5 percent, sedges; 5 percent, inland saltgrass; 5 percent, annual forbs; 5 percent, annual grasses; and 5 percent, salt cedar, cottonwood, and hackberry.

Deteriorated range can be recovered by reseeding followed by deferred grazing, but seeding is not practical in areas that are subject to flooding.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,200 to 3,400 pounds per acre in areas where the water table is low to 3,200 to 4,000 pounds per acre in areas where the water table is high in years of favorable rainfall. About 75 percent of this vegetation is forage for livestock and wildlife.

MIXEDLAND RANGE SITE

This site is gently sloping to strongly sloping and rolling. The soils are loamy and moderately permeable to moderately rapidly permeable. The drainage pattern is well defined.

The climax plant community is a mixture of tall and mid grasses and forbs. About 25 percent, by weight, of the plant community is sideoats grama; 5 percent, vine mesquite; 15 percent, little bluestem; 20 percent, blue grama; 5 percent, buffalograss; 5 percent, silver bluestem; 5 percent, sand dropseed; 5 percent, hairy grama; 5 percent, annual grasses; and 10 percent, annual forbs.

Deteriorated range can be recovered by controlling brush, reseeding to adapted grasses, and deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,200 to 2,000 pounds per acre in years of favorable rainfall. About 90 percent of this vegetation is forage for livestock and wildlife.

MIXEDLAND SLOPES RANGE SITE

This site is gently sloping to moderately steep. These soils are loamy, deep, and moderately rapidly permeable to moderately permeable.

The climax plant community is a mixture of tall and mid grasses and forbs. About 20 percent, by weight, of the plant community consists of sideoats grama; 25 percent, little bluestem; 10 percent, sand bluestem; 15 percent, blue grama; 5 percent, buffalograss; 5 percent, sand dropseed; 5 percent, sand sagebrush; 5 percent, yucca; 5 percent, annual grasses; and 5 percent, annual forbs.

Deteriorated range can be recovered by seeding and deferred grazing. If sagebrush has invaded, these areas can be improved by controlling the brush followed by deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage per acre ranges from 1,400 to 2,200 pounds per acre in years of favorable rainfall. About 80 percent of this vegetation is forage for livestock and wildlife.

ROUGH BREAKS RANGE SITE

This site is steep valley escarpments, ridges, and gullies. The soils are rocky and loamy materials that are very shallow to deep and moderately permeable. Some areas are not accessible to livestock.

The climax plant community is a mixture of tall and mid grasses and forbs. About 25 percent, by weight, of the plant community is little bluestem; 20 percent, sideoats grama; 10 percent, sand bluestem; 5 percent, indiangrass; 10 percent, switchgrass; 10 percent, hairy grama; 5 percent, skunkbush sumac; 5 percent, annual grasses; and 10 percent, annual forbs.

Deteriorated range can be recovered by deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 500 to 900 pounds per acre in years of favorable rainfall. About 50 percent of this vegetation is forage for livestock and wildlife.

SANDY RANGE SITE

This site is gently sloping to sloping. The soils are sandy, deep, and moderately rapidly permeable.

The climax plant community is a mixture of tall and mid grasses and forbs. About 15 percent, by weight, of the plant community is little bluestem; 10 percent, sand bluestem; 5 percent, indiangrass; 10 percent, switchgrass; 5 percent, sand lovegrass; 5 percent, blue grama; 10 percent, sideoats grama; 5 percent, threeawns; 5 percent, sand dropseed; 10 percent, sand sagebrush; 5 percent, shin oak; 5 percent, skunkbush; 5 percent, annual grasses; and 5 percent, annual forbs.

Deteriorated range can be recovered by seeding. Controlling brush and deferred grazing are effective in less deteriorated areas.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,500 to 3,000 pounds per acre in years of favorable rainfall. About 75 percent of this vegetation is forage for livestock and wildlife.

SANDY BOTTOMLAND RANGE SITE

This site is on flood plains along streams and the river. The soils are nearly level, sandy, deep, and rapidly permeable. In some areas the water table is within 3 to 5 feet of the surface. Some areas are subject to occasional flooding.

The climax plant community is a mixture of tall and mid grasses and forbs. About 25 percent, by weight, of the plant community is switchgrass; 20 percent, indiangrass; 10 percent, sand bluestem; 10 percent, little bluestem; 5 percent, sideoats grama; 5 percent, Canada wildrye; 5 percent, silver bluestem; 5 percent, inland saltgrass; 5 percent, plains cottonwood; 5 percent, annual grasses; and 5 percent, annual forbs.

Deteriorated range that is not subject to flooding can be recovered by reseeding followed by deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 1,800 to 2,900 pounds per acre in areas that have no water table and from 2,100 to 3,000 pounds per acre in areas that have a water table in years of favorable rainfall. About 75 percent of this vegetation is forage for livestock and wildlife.

SANDY LOAM RANGE SITE

This site is nearly level to gently sloping plains. The soils are loamy, deep, and moderately permeable. They are affected by surface crusting when unprotected by plant cover.

The climax plant community is a mixture of tall and mid grasses and forbs. About 20 percent, by weight, of the plant community is sideoats grama; 10 percent, little bluestem; 5 percent, sand bluestem; 5 percent, indiangrass; 10 percent, switchgrass; 5 percent, Canada wildrye; 15 percent, blue grama; 5 percent, buffalograss; 5 percent, sand dropseed; 5 percent, sand sagebrush; 5 percent, annual grasses; and 10 percent, annual forbs.

Deteriorated range can be recovered by interseeding to desirable grasses. If sand sagebrush has invaded, these areas can be recovered by controlling brush followed by deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,000 to 3,000 pounds per acre in years of favorable rainfall. About 85 percent of this vegetation is forage for livestock and wildlife.

VALLEY RANGE SITE

This site is nearly level flood plains along streams. The soils are deep, loamy, and moderately permeable. They receive runoff from adjacent slopes, and some are subject to flooding and sediment deposition.

The climax plant community is a mixture of tall and mid grasses and forbs. About 20 percent, by weight, of the plant community is switchgrass; 15 percent,

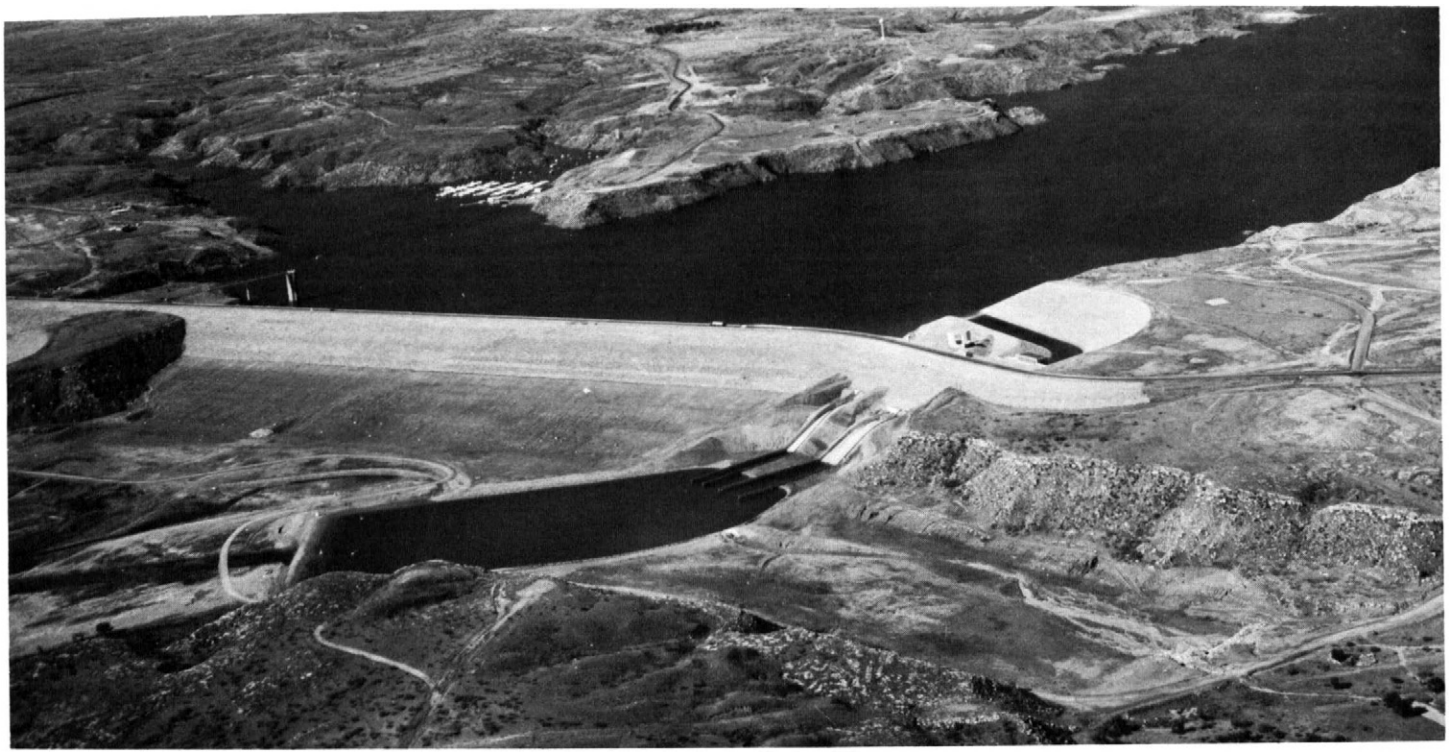


Figure 7.—**An aerial view of Lake Meredith. Along the lake are Tascosa and Burson soils.**

indiangrass; 5 percent, little bluestem; 5 percent, sideoats grama; 5 percent, Canada wildrye; 5 percent, eastern gamagrass; 10 percent, western wheatgrass; 5 percent, alkali sacaton; 5 percent, tall dropseed; 5 percent, sedges; 5 percent, inland saltgrass; 5 percent, annual forbs; 5 percent, annual grasses; and 5 percent, cottonwood and hackberry.

Deteriorated range can be recovered by reseeding followed by deferred grazing. Seeding is not practical in areas that are subject to flooding.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 2,000 to 3,400 pounds per acre in areas where the water table is low to 3,200 to 4,000 pounds per acre in areas where the water table is high in years of favorable rainfall. About 75 percent of this vegetation is forage for livestock and wildlife.

VERY SHALLOW RANGE SITE

This site is in sloping to moderately steep areas along caprock escarpments, ridges, knobs, and convex areas. The soils are loamy, very shallow, and moderately permeable. Caliche gravel or rock is exposed in many places.

The climax plant community is a mixture of tall and mid grasses and forbs. About 15 percent, by weight, of the plant community is little bluestem; 5 percent, sand bluestem; 5 percent, indiangrass; 10 percent, switchgrass; 5 percent, dotted gayfeather; 5 percent, black sampson; 20 percent, sideoats grama; 5 percent, hairy grama; 5 percent, blue grama; 5 percent, threeawn; 5 percent, rough tridens; 5 percent, annual grasses; and 10 percent, annual forbs.

Deteriorated range can be recovered by deferred grazing.

If this site is in excellent condition, the total annual yield of air-dry herbage ranges from 400 to 850 pounds per acre in years of favorable rainfall. About 70 percent of this vegetation is forage for livestock and wildlife.

Wildlife

In Hutchinson County, the principal kinds of wildlife are whitetail deer, mule deer, turkey, pheasant, scaled (blue) quail, bobwhite quail, dove, antelope, cottontail rabbit, jackrabbit, and many kinds of nongame birds. Also present are badgers, prairie dogs, porcupine, foxes, skunks, and opposum. The common predators are bobcats and coyotes. Lake Meredith, playa lakes, ponds, and grain fields attract ducks and geese during migration. Most farm and ranch ponds are stocked with fish. The fish, wildlife, and recreation facilities in the county are of great economic and environmental importance to the county (fig. 7).

Soils directly influence the kinds and amounts of vegetation and the amounts of available water. They indirectly influence the kinds of wildlife that can live in the area. The soil properties that affect the growth of wildlife habitat are thickness of the soil, texture of the surface layer, available water capacity to a depth of 40 inches, wetness, stones or rocks on the surface, hazard of flooding, slope, and permeability of the soil to air and water.

TABLE 3.—*Wildlife*

Soil series and map symbols	Elements of wildlife habitat				Kinds of wildlife	
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Openland	Rangeland
Berda:						
BeB, BeC	Fair	Fair	Fair	Fair	Fair	Fair.
BPF	Very poor	Very poor	Fair	Fair	Poor	Fair.
For Potter part, see Potter series. Caliche outcrop part is too variable to be rated.						
BSD, BVE	Poor	Fair	Fair	Fair	Fair	Fair.
For Mansker part of BSD, and for Veal part of BVE, see those series.						
Burson: BxF	Very poor	Very poor	Poor	Very poor	Poor	Very poor.
Caliche outcrop. Mapped only with Berda and Potter soils. Too variable to be rated.						
Clairemont: Ca	Good	Good	Good	Good	Good	Good.
Conlen: CnA, CnB, CnC	Fair	Fair	Fair	Fair	Fair	Fair.
Dallam: DaA, DaB, DaC, DrB	Fair	Fair	Fair	Fair	Fair	Fair.
Urban land part of DrB is too variable to be rated.						
Dumas: DsA, DsB, DuA	Fair	Fair	Fair	Fair	Fair	Fair.
Gruver: GrA, GrB	Fair	Fair	Fair	Fair	Fair	Fair.
Humbarger:						
Hm	Good	Fair	Fair	Fair	Fair	Fair.
Hu	Very poor	Poor	Fair	Fair	Poor	Fair.
Likes: LkC	Poor	Fair	Good	Fair	Fair	Fair.
Lincoln: Ln	Very poor	Poor	Good	Fair	Fair	Fair.
Mansker	Poor	Fair	Fair	Fair	Fair	Fair.
Mapped only with Berda soils.						
Mobeetie:						
MbB, MbC	Fair	Fair	Fair	Fair	Fair	Fair.
MbD, MVE	Poor	Fair	Fair	Fair	Fair	Fair.
For Veal part of MVE, see Veal series.						
Ness: Ne	Very poor	Poor	Poor	Poor	Poor	Poor.
Obaro:						
OaB, OaC	Fair	Fair	Fair	Fair	Fair	Fair.
ObD, OQE	Poor	Fair	Fair	Fair	Fair	Fair.
Urban land part of ObD is too variable to be rated. For Quinlan part of OQE, see Quinlan series.						
Potter: PtE	Very poor	Very poor	Poor	Poor	Poor	Poor.
Quinlan	Poor	Fair	Fair	Poor	Fair	Poor.
Mapped only with Obaro soils.						
Sherm: ShA, ShB	Fair	Fair	Fair	Fair	Fair	Fair.
Sunray: SuA, SuB	Fair	Fair	Fair	Fair	Fair	Fair.
Sweetwater: Sw	Very poor	Poor	Poor	Poor	Poor	Poor.
Tascosa: TaE	Poor	Poor	Fair	Fair	Poor	Fair.
Tivoli: Tv	Very poor	Very poor	Fair	Fair	Poor	Fair.
Urban land. Mapped only with Dallam, Obaro, and Veal soils. Too variable to be rated.						
Veal: VeB, VeC, VuC	Fair	Fair	Fair	Fair	Fair	Fair.
Urban land part of VuC is too variable to be rated.						
Yahola: Ya	Fair	Good	Good	Good	Good	Good.

In table 3 the soils of the county are rated to indicate their relative suitability for producing four elements of wildlife habitat and for supporting two groups, or kinds, of wildlife. A rating of *good* means that the elements of wildlife habitat generally are easily created, improved, and maintained. In this category, few or no limitations affect management and satisfactory results can be expected.

A rating of *fair* means that the elements of wildlife habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results.

A rating of *poor* means that the elements of wildlife habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of *very poor* means that it is either impossible or impractical to create, improve, or maintain the elements of wildlife habitat on the soils in this category and that unsatisfactory results can be expected.

Following are explanations of the columns in table 3.

Elements of wildlife habitat.—Each soil is rated according to its suitability for producing various kinds of plants and other elements that make up a wildlife habitat. The ratings mainly take into account the characteristics of the soils and the closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, onsite inspection is necessary in selecting a site for development as a habitat for wildlife.

Grain and seed crops are annual grain-producing plants. They include sorghum, millet, and soybeans.

Grass and legumes are domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include ryegrass and panicgrass, and legumes include annual lespedeza and clovers.

Wild herbaceous upland plants consist of native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. These plants include beggarweed, perennial lespedeza, wild bean, pokeweed, and cheatgrass. The typical plants on range are bluestem, grama, perennial forbs, and legumes.

Shrubs are plants that produce food for wildlife in the form of fruits, nuts, buds, or browse. The typical plants in this category are shinnery oak, mesquite, and catclaw.

Ratings are not given for wetland food and cover plants because most of the soils in the county are rated very poor. Only the Lincoln soils are rated fair for such plants. Wetland food and cover plants are annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples of these plants are smartweed, wild millet, spikerush and true rushes, sedges, burreed, tearthumb, and aneilema. Submerged and floating aquatic plants are not included in this category.

Ratings are not given for shallow water development because most of the soils in the county are rated very poor. Only the Ness and Sweetwater soils are rated fair. Shallow water developments are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded, and others are permanent impoundments that grow submersed aquatics.

Kinds of Wildlife.—Table 3 rates soils according to their suitability as habitat for openland and rangeland wildlife. These ratings are related to those made for the elements of habitat. The soils rated fair for wild herbaceous upland plants and shrubs, for example, are rated fair for rangeland wildlife.

Openland wildlife are birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, cottontail, pheasant, rabbits, and foxes are typical kinds of wildlife in this group.

Rangeland wildlife are birds and mammals that normally frequent native range. Examples of this kind of wildlife are antelope, deer, badgers, foxes, coyotes, turkey, and porcupine.

Recreational Development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 4 the soils of Hutchinson County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails.

In table 4 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these is required.

"Camp areas" are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, and a surface free of rocks and coarse fragments that is firm after rain but not dusty when dry; they are not subject to flooding during periods of heavy use.

"Picnic areas" are attractive natural or landscaped tracts. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils for picnic area use are those that are firm when wet but not dusty when dry, are not subject to flooding during the season of use, and do not have slopes or stoniness that greatly increase cost of leveling or of building access roads.

"Playgrounds" are areas used intensively for baseball, football, badminton, and other organized games. Soils suitable for this use need to withstand intensive

foot traffic. The best soils are nearly level and have good drainage; they have a surface free of coarse fragments and rock outcrops that is firm after rain but not dusty when dry; and they are not subject to flooding during periods of heavy use. If grading and leveling are required, depth to rock is important.

"Paths and trails" are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Engineering Uses of the Soils [3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, shear strength, compressibility, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables. Table 5 shows several estimated soil properties significant to engineering, and table 6 gives interpretations for various engineering uses. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 5 and 6, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally a depth of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*7*) used by the SCS engineers, Department of Defense, and others, and the AASHTO system adopted by the American Association of State Highways and Transportation Officials (*1*).

In the Unified system soils are classified according to particle size distribution, plasticity, liquid limit, and content of organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL-ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification is given in table 5 for all soils mapped in the survey area.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for representative soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observation made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of

[3] By JOHN JACKSON, engineer, Soil Conservation Service, Pampa.

TABLE 4.—*Degree and kind of limitation of soils for recreational development*

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Berda:				
BeB, BeC	Slight	Slight	Moderate: slope	Slight.
BPF	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
For Potter part, see Potter series. Caliche outcrop part is too variable to be rated.				
BSD	Slight	Slight	Severe: slope	Slight.
For Mansker part, see Mansker series.				
BVE	Moderate: slope	Moderate: slope	Severe: slope	Slight.
For Veal part, see Veal series.				
Burson: BxF	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Caliche outcrop. Mapped only with Berda and Potter soils. Too variable to be rated.				
Clairemont: Ca	Severe: hazard of flooding.	Moderate: hazard of flooding.	Severe: hazard of flooding.	Slight.
Conlen:				
CnA, CnB	Slight	Slight	Slight	Slight.
CnC	Slight	Slight	Moderate: slope	Slight.
Dallam:				
DaA, DaB, DrB	Slight	Slight	Slight	Slight.
Urban land part of DrB is too variable to be rated.				
DaC	Slight	Slight	Moderate: slope	Slight.
Dumas:				
DsA, DsB	Slight	Slight	Slight	Slight.
DuA	Moderate: clay loam.	Moderate: clay loam.	Moderate: clay loam.	Moderate: clay loam.
Gruver: GrA, GrB	Moderate: clay loam.	Moderate: clay loam.	Moderate: clay loam.	Moderate: clay loam.
Humbarger: Hm, Hu	Severe: hazard of flooding.	Moderate: hazard of flooding; clay loam.	Moderate: hazard of flooding; clay loam.	Moderate: clay loam.
Likes: LkC	Moderate: loamy fine sand.	Moderate: loamy fine sand.	Moderate: loamy fine sand.	Moderate: loamy fine sand.
Lincoln: Ln	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Moderate: hazard of flooding.
Mansker	Slight	Slight	Severe: slope	Slight.
Mapped only with Berda soils.				
Mobeetie:				
MbB	Slight	Slight	Slight	Slight.
MbC	Slight	Slight	Moderate: slope	Slight.
MbD, MVE	Moderate: slope	Moderate: slope	Severe: slope	Slight.
For Veal part of MVE, see Veal series.				
Ness: Ne	Severe: hazard of flooding; clay.	Severe: hazard of flooding; clay.	Severe: hazard of flooding; clay.	Severe: hazard of flooding; clay.
Obaro:				
OaB, OaC	Slight	Slight	Slight	Slight.
ObD, OQE	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Urban land part of ObD is too variable to be rated. For Quinlan part of OQE, see Quinlan series.				
Potter: PtE	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Quinlan	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Mapped only with Obaro series.				
Sherm: ShA, ShB	Severe: very slow permeability.	Moderate: clay loam.	Severe: very slow permeability.	Moderate: clay loam.

TABLE 4.—*Degree and kind of limitation of soils for recreational development*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Sunray: SuA, SuB	Moderate: clay loam.	Moderate: clay loam.	Moderate: clay loam.	Moderate: clay loam.
Sweetwater: Sw	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Tascosa: TaE	Moderate: slope; coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
Tivoli: Tv	Severe: fine sand	Severe: fine sand	Severe: fine sand	Severe: fine sand.
Urban land. Mapped only with Dallam, Obaro, and Veal soils. Too variable to be rated.				
Veal:				
VeB	Slight	Slight	Slight	Slight.
VeC, VuC	Slight	Slight	Moderate: slope	Slight.
Urban land part of VuC is too variable to be rated.				
Veal part of BVE and MVE	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Yahola: Ya	Severe: hazard of flooding.	Moderate: hazard of flooding.	Severe: hazard of flooding.	Slight.

soil in other counties. Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years. The depth to seasonal high water table is not a concern in Hutchinson County, and it was not included in the table. The seasonal high water table is at a depth of 1 to 2 feet in Sweetwater soils, and it is at a depth of 3 to 5 feet in Lincoln soils. Following are explanations of some of the columns in table 5.

Hydrologic groups give the runoff potential from rainfall. The soils are classified on the basis of intake of water at the end of storms that are long in duration, after prior wetting and opportunity for swelling and with no protective vegetation.

The four major soil groups are:

A. The soils that have low runoff potential and a high infiltration rate when thoroughly wet are chiefly deep and well drained to excessively drained sands or gravels. They allow water to pass readily through them.

B. The soils that have a moderate infiltration rate when thoroughly wet are chiefly moderately deep to deep, moderately well drained to well drained, and moderately fine textured to moderately coarse textured. They have a moderate rate of water transmission.

C. The soils that have a slow infiltration rate when thoroughly wet are chiefly soils that have a layer that impedes downward movement of water or soils that are moderately fine textured to fine textured. They have a slow rate of water transmission.

D. The soils that have high runoff potential and a very slow infiltration rate when thoroughly wet are chiefly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. They have a very slow rate of water transmission.

Depth to bedrock is distance from the surface to the upper part of the consolidated material.

Texture is described in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added; for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic. If the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic; and the liquid limit from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Permeability is the quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water

in the soil at field capacity and the amount at the wilting point of most crops.

Reaction is the degree of acidity or alkalinity of a soil expressed in pH values. The pH value and terms used to describe reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of the soil as moisture content changes; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity as used in table 5 pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel should be used to avoid or minimize damage. All soils in Hutchinson County have a low corrosivity rating for concrete.

Engineering interpretations of soils

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Hutchinson County. In table 6, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage of cropland and pasture, irrigation, ponds and reservoirs, embankments, and terraces and diversions. For these particular uses, table 6 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties generally are favorable for the rated use, or in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special designs.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 6.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, content of organic matter, and slope, and if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings without basements, as rated in table 6, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 6 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 6, have an

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The as indicated in the first column of this table. Absence of data indicates that the soil is too

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	USDA texture	Classification	
					Unified	AASHTO
		Inches	*Inches*			
*Berda: BeB, BeC, BPF, BSD, BVE	B	>60	0–8	Loam	SC, CL	A–4, A–6
			8–80	Loam	SC, CL	A–4, A–6
Caliche outcrop part is too variable to be estimated. For Potter part of BPF, for Mansker part of BSD, and for Veal part of BVE, see those series.						
Burson: BxF	C	3–12	0–6	Loam	ML, CL, CL-ML	A–4
			6–40	Weakly cemented sandstone and siltstone.		
Caliche outcrop. Mapped only with Berda and Potter soils. Too variable to be estimated.						
Clairemont: Ca	B	>60	0–60	Silt loam, silty clay loam.	CL	A–6, A–7
Conlen: CnA, CnB, CnC	B	>60	0–10	Loam	CL, CL-ML, SC, SM-SC	A–4, A–6
			10–34	Clay loam	CL, SC	A–6, A–4
			34–80	Clay loam	CL	A–6
Dallam: DaA, DaB, DaC, DrB	B	>60	0–7	Fine sandy loam	SM	A–4
			7–50	Sandy clay loam	CL, SC	A–6, A–4
Urban land part of DrB is too variable to be estimated.			50–80	Fine sandy loam	SM	A–4
Dumas: DsA, DsB, DuA	B	>60	0–10	Loam	CL-ML, CL	A–4, A–6
			10–36	Clay loam	CL	A–6, A–7
			36–84	Clay loam	CL	A–4, A–6
Gruver: GrA, GrB	C	>60	0–7	Clay loam	CL	A–6, A–4
			7–48	Clay loam	CL	A–6, A–7–6
			48–80	Clay loam	CL	A–6, A–7–6
Humbarger: Hm, Hu	B	>60	0–40	Clay loam	CL	A–6
			40–60	Loam	CL-ML, CL	A–4, A–6
Likes: LkC	A	>60	0–80	Loamy fine sand	SM-SC, SM	A–2–4
Lincoln: Ln	A	>60	0–63	Loamy fine sand	SM	A–4
Mansker	B	>60	0–16	Loam	CL-ML, CL, SM-SC, SC	A–6, A–4
Mapped only with Berda soils.			16–38	Clay loam	CL	A–6, A–4
			38–68	Clay loam	CL	A–6, A–4
*Mobeetie: MbB, MbC, MbD, MVE	B	>60	0–80	Fine sandy loam	SM-SC, SM, CL-ML, ML	A–4
For Veal part of MVE, see Veal series.						
Ness: Ne	D	>60	0–44	Clay	CL, CH	A–7
			44–80	Silty clay loam	CL	A–6, A–7
*Obaro: OaB, OaC, ObD, OQE	B	28–40	0–37	Loam	CL-ML, CL	A–4, A–6
Urban land part of ObD is too variable to be estimated. For Quinlan part of OQE, see Quinlan series.			37–60	Weakly cemented sandstone.	CL-ML, ML	A–4
Potter: PtE	C	5–8	0–6	Loam	CL, CL-ML	A–6, A–4
			6–40	Gravelly loam and platy caliche.	GM, GC, SM, SC	A–2, A–4, A–6
Quinlan	C	12–18	0–17	Loam	CL, SC	A–6, A–4
Mapped only with Obaro soils.			17–50	Weakly cemented sandstone.		

significant to engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other series variable to be estimated. The symbol > means more than; the symbol < means less than]

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity of uncoated steel
	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
Percent							*Inches per hour*	*Inches per inch of soil*	*pH*		
0–3	90–100	85–100	80–95	36–70	20–35	8–20	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
0	95–100	95–100	80–95	40–70	20–35	8–20	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
0	95–100	90–100	85–100	55–85	20–30	3–10	0.6–2.0	0.10–0.16	7.9–8.4	Low	Low.
0	100	100	100	85–98	30–45	11–25	0.6–2.0	0.16–0.19	7.9–8.4	Low	Low.
0	95–100	95–100	80–95	36–70	20–35	5–20	0.6–2.0	0.14–0.18	7.9–8.4	Low	Moderate.
0	90–100	85–98	85–98	40–80	20–35	8–20	0.6–2.0	0.10–0.16	7.9–8.4	Low	Moderate.
0	98–100	95–100	90–98	51–80	25–40	11–25	0.6–2.0	0.14–0.18	7.9–8.4	Low	Moderate.
0	100	100	70–85	36–50		[1]NP	2.0–6.0	0.10–0.14	6.6–7.3	Low	Low.
0	100	98–100	80–95	45–70	25–35	8–20	0.6–2.0	0.14–0.18	7.4–8.4	Low	Moderate.
0	100	100	70–85	36–50		NP	2.0–6.0	0.10–0.14	7.9–8.4	Low	Low.
0	100	100	95–100	51–75	25–35	4–15	0.6–2.0	0.12–0.16	6.6–7.3	Low	Low.
0	100	100	95–100	65–85	35–45	15–25	0.6–2.0	0.14–0.18	7.4–8.4	Moderate	Moderate.
0	100	90–100	85–95	60–75	25–35	8–20	0.6–2.0	0.12–0.18	7.9–8.4	Low	Moderate.
0	100	95–100	85–100	55–75	20–35	8–20	0.6–2.0	0.15–0.20	6.6–7.3	Low	Moderate.
0	100	95–100	90–100	70–90	35–50	20–35	0.2–0.6	0.15–0.20	7.4–8.4	Moderate	Moderate.
0	95–100	90–100	90–100	60–80	25–45	11–25	0.2–0.6	0.10–0.16	7.9–8.4	Moderate	Moderate.
0	95–100	90–100	80–95	55–80	25–40	11–20	0.6–2.0	0.15–0.19	7.9–8.4	Moderate	Moderate.
0	100	100	95–100	51–70	25–35	4–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Low.
0	90–98	90–98	75–95	13–30	<25	NP–6	2.0–6.0	0.06–0.10	7.9–8.4	Very low	Low.
0	100	100	50–90	36–50		NP	6.0–2.0	0.06–0.09	7.9–8.4	Very low	Low.
0	95–100	95–98	85–95	36–70	20–35	5–20	0.6–2.0	0.15–0.18	7.9–8.4	Low	Low.
0	90–100	90–100	85–95	51–80	25–35	8–20	0.6–2.0	0.07–0.12	7.9–8.4	Low	Moderate.
0	98–100	98–100	90–98	60–80	25–40	8–25	0.6–2.0	0.14–0.18	7.9–8.4	Low	Moderate.
0–3	95–98	90–95	80–95	40–65	18–25	2–7	2.0–6.0	0.10–0.14	7.9–8.4	Very low	Low.
0	100	100	96–100	90–95	41–65	20–40	<0.06	0.14–0.18	6.6–7.8	High	High.
0	100	100	95–100	85–95	30–45	11–30	0.06–0.20	0.16–0.20	7.4–7.8	Moderate	High.
0	95–98	92–97	90–96	75–85	25–35	7–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Low.
0	95–99	90–99	90–98	60–75	20–26	2–6	0.6–2.0	0.04–0.08	7.9–8.4	Very low	Low.
0	80–95	70–90	60–85	51–70	30–40	5–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Moderate.
0	30–80	25–75	20–60	13–50	31–40	5–15	0.6–2.0	0.01–0.04	7.9–8.4	Very low	Moderate.
0	100	95–100	90–100	45–60	25–35	8–15	2.0–6.0	0.15–0.19	7.9–8.4	Low	Low.

TABLE 5.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The as indicated in the first column of this table. Absence of data indicates that the soil is too

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	USDA texture	Classification	
					Unified	AASHTO
		Inches	*Inches*			
Sherm: ShA, ShB	D	>60	0–6	Clay loam	CL	A–6, A–7
			6–20	Clay	CH, CL	A–7
			20–80	Clay loam	CL	A–6, A–7
Sunray: SuA, SuB	B	>60	0–10	Clay loam	CL	A–6, A–4
			10–22	Clay loam	CL	A–6, A–7–6
			22–80	Clay loam	CL	A–7–6, A–6
Sweetwater: Sw	D	>60	0–16	Silty clay loam	SC, CL	A–6
			16–60	Loamy sand	SM	A–2–4
Tascosa: TaE	B	>60	0–8	Gravelly loam	SM, SM-SC, SP-SM	A–1, A–2
			8–60	Very gravelly loam, very gravelly sandy loam.	SM, GM, GM-GP, GC, SC, SP-SM	A–1, A–2
Tivoli: Tv	A	>60	0–84	Fine sand	SM, SP-SM	A–2, A–3
Urban land. Mapped only with Dallam, Obaro, or Veal soils. Too variable to be estimated.						
Veal: VeB, VeC, VuC. Urban land part of VuC is too variable to be estimated.	B	>60	0–6	Fine sandy loam	SM, SC, SM-SC	A–2, A–4
			6–66	Sandy clay loam	CL, SC	A–6, A–4
			66–80	Fine sandy loam	SM, SC, SM-SC	A–2, A–4
Yahola: Ya	B	>60	0–63	Fine sandy loam	ML, SM, SM-SC, CL-ML	A–2, A–4

[1]NP=Nonplastic.

all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stablized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Pond embankments are raised structures of soil material constructed across drainageways in order to impound water. These embankments are generally less than 20 feet high, are constructed of homogeneous soil material and compacted to medium density. Embankments having core and shell type construction are not rated in this table. Embankment foundation, reservoir area, and slope are assumed to be suitable for pond construction. Soil properties are considered that affect the embankment and the availability of borrow material. The best soils have good slope stability, low permeability, slight compressibility under load, and good resistance to piping and erosion. The best borrow material is free of stones or rocks and thick enough for easy excavation.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

significant to engineering—Continued

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other series variable to be estimated. The symbol > means more than; the symbol < means less than]

Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity of uncoated steel
	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
Percent							*Inches per hour*	*Inches per inch of soil*	*pH*		
0	100	100	100	85–96	35–42	15–25	0.06–0.02	0.16–0.20	6.6–7.3	Moderate	High.
0	100	100	100	80–99	44–57	20–35	<0.06	0.15–0.19	7.4–8.4	High	High.
0	97–100	95–100	94–99	75–92	31–43	15–26	0.2–0.6	0.13–0.17	7.9–8.4	Moderate	High.
0	98–100	100	95–100	51–85	25–40	8–25	0.6–2.0	0.14–0.18	7.9–8.4	Low	Moderate.
0	95–100	95–100	85–100	55–90	30–42	11–25	0.6–2.0	0.12–0.16	7.9–8.4	Low	Moderate.
0	95–100	95–100	95–100	60–95	30–45	15–25	0.6–2.0	0.13–0.17	7.9–8.4	Low	Moderate.
0	100	95–100	80–95	40–70	25–40	11–20	0.2–0.6	0.16–0.20	7.9–8.4	Low	High.
0	95–100	90–100	50–80	15–35		NP	6.0–20	0.04–0.10	7.9–8.4	Low	High.
0–10	50–75	35–60	30–50	10–25	<25	NP–7	0.6–2.0	0.06–0.09	7.9–8.4	Very low	Low.
5–15	40–60	25–50	30–45	10–25	10–30	3–10	0.6–2.0	0.05–0.10	7.9–8.4	Very low	Low.
0–5	100	100	85–95	9–20		NP	6.0–20	0.04–0.06	6.6–8.4	Very low	Low.
0–2	95–100	95–100	85–95	30–50	15–25	3–10	2.0–6.0	0.10–0.14	7.9–8.4	Low	Moderate.
0–5	95–100	95–100	90–100	40–70	20–30	8–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Moderate.
0–2	95–100	95–100	75–85	30–45	15–25	3–10	2.0–6.0	0.10–0.13	7.9–8.4	Low	Moderate.
0	100	100	85–98	30–55	<26	NP–6	2.0–6.0	0.11–0.15	7.9–8.4	Low	Low.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. A soil rated as a probable source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit. Because Tascosa soils are the only source of sand and gravel, this column was deleted from table 6.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Waterways are either natural or shaped channels seeded with grass to carry runoff without causing erosion. The suitability of a soil for grassed waterways is determined by the erosion hazard; the amount of shaping that can be done, which in turn depends on slope, stoniness, and depth to bedrock; and the difficulty in establishing vegetation.

TABLE 6.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The
as indicated in the first

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfills
*Berda: BeB, BeC	Slight	Moderate: moderate permeability; slope.	Slight	Slight	Slight
BPF For Potter part, see Potter series. Caliche outcrop part is too variable to be rated.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
BSD For Mansker part, see Mansker series.	Slight	Moderate: moderate permeability; slope.	Slight	Slight	Slight
BVE For Veal part, see Veal series.	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight
Burson: BxF	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope
Caliche outcrop. Mapped only with Berda and Potter soils. No interpretations made; properties too variable.					
Clairemont: Ca	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Conlen: CnA, CnB, CnC	Slight	Moderate: moderate permeability.	Slight	Slight	Moderate: clay loam.
Dallam: DaA, DaB, DaC, DrB Urban land part of DrB is too variable to be rated.	Slight	Moderate: moderate permeability.	Slight	Slight	Slight
Dumas: DsA, DsB, DuA	Moderate: moderate permeability.	Moderate: moderate permeability.	Moderate: clay loam.	Moderate: moderate shrink-swell potential.	Moderate: clay loam.
Gruver: GrA, GrB	Severe: moderately slow permeability.	Slight	Moderate: clay loam.	Moderate: moderate shrink-swell potential.	Moderate: clay loam.
Humbarger: Hm, Hu	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Likes: LkC	Slight	Severe: moderately rapid permeability.	Severe: loamy fine sand.	Slight	Moderate: loamy fine sand.

engineering properties of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other series column of this table]

Degree and kind of limitation for—Continued			Suitability as a source of—		Soil features affecting—		
Local roads and streets	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Moderate: low strength.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Erodible	Erodible	Erodible.
Severe: slope	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Severe: slope	Severe: slope	Slope	Slope	Slope.
Moderate: low strength.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Slope	Slope	Slope.
Moderate: low strength; slope.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Fair: slope	Slope	Slope	Slope.
Severe: slope	Severe: bedrock at depth of 3 to 12 inches.	Severe: 3 to 12 inches of material.	Poor: bedrock at depth of 3 to 12 inches.	Poor: slope	Slope; soil depth.	Slope; soil depth.	Slope; soil depth.
Severe: hazard of flooding.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Hazard of flooding.	Nearly level; hazard of flooding.	Hazard of flooding.
Moderate: low strength.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Fair: 8 to 12 inches of loam.	Erodible	Erodible	Erodible.
Moderate: low strength.	Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Fair: low strength.	Fair: 6 to 12 inches of fine sandy loam.	Moderate permeability; erodible.	Erodible	Erodible.
Moderate: moderate shrink-swell potential.	Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Fair: moderate shrink-swell potential.	Fair: 6 to 12 inches of loam.	All features favorable.	All features favorable.	All features favorable.
Moderate: moderate shrink-swell potential.	Moderate: moderately slow permeability.	Moderate: poor to fair resistance to piping and erosion.	Fair: moderate shrink-swell potential.	Fair: clay loam.	All features favorable.	All features favorable.	All features favorable.
Severe: hazard of flooding.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: moderate shrink-swell potential.	Fair: clay loam.	Moderate permeability.	Receives outside water.	All features favorable.
Slight	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Good	Poor: loamy fine sand.	High intake rate.	High susceptibility to soil blowing.	Highly unstable; erodible.

TABLE 6.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The as indicated in the first

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfills
Lincoln: Ln	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Mansker Mapped only with Berda soils.	Slight	Moderate: moderate permeability; slope.	Slight	Slight	Moderate: clay loam.
*Mobeetie: MbB, MbC	Slight	Severe: moderately rapid permeability.	Slight	Slight	Severe: moderately rapid permeability.
MbD, MVE For Veal part of MVE, see Veal series.	Moderate: slope.	Severe: moderately rapid permeability; slope.	Moderate: slope.	Moderate: slope.	Severe: moderately rapid permeability.
Ness: Ne	Severe: very slow permeability; hazard of flooding.	Severe: hazard of flooding.	Severe: poorly drained; hazard of flooding.	Severe: high shrink-swell potential; hazard of flooding.	Severe: poorly drained; clay; hazard of flooding.
*Obaro: OaB, OaC, ObD, OQE Urban land part of ObD is too variable to be rated. For Quinlan part of OQE, see Quinlan series.	Severe: bedrock at depth of 28 to 40 inches.	Severe: bedrock at depth of 28 to 40 inches.	Moderate: bedrock at depth of 28 to 40 inches; slope.	Moderate: bedrock at depth of 28 to 40 inches; slope.	Moderate: bedrock at depth of 28 to 40 inches.
Potter: PtE	Moderate: slope.	Severe: seepage.	Moderate: slope.	Moderate: slope.	Moderate: slope.
Quinlan Mapped only with Obaro soils.	Severe: bedrock at depth of 12 to 18 inches.	Severe: bedrock at depth of 12 to 18 inches.	Moderate: rippable bedrock at depth of 12 to 18 inches.	Moderate: rippable bedrock at depth of 12 to 18 inches.	Moderate: rippable bedrock at depth of 12 to 18 inches.
Sherm: ShA, ShB	Severe: very slow permeability.	Slight	Severe: clay	Severe: high shrink-swell potential.	Severe: clay
Sunray: SuA, SuB	Slight	Moderate: moderate permeability.	Moderate: clay loam.	Moderate: low strength.	Moderate: clay loam.
Sweetwater: Sw	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.
Tascosa: TaE	Moderate: slope.	Severe: slope; seepage.	Severe: very gravelly loam.	Moderate: slope.	Severe: very gravelly loam.

properties of the soils—Continued

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other series column of this table]

Degree and kind of limitation for—Continued			Suitability as a source of—		Soil features affecting—		
Local roads and streets	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Severe: hazard of flooding.	Severe: rapid permeability.	Moderate: poor resistance to piping and erosion.	Good	Poor: loamy fine sand.	Hazard of flooding.	Hazard of flooding.	Hazard of flooding.
Moderate: low strength.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Moderate permeability; erodible.	Erodible	Erodible.
Slight	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Fair: low strength.	Good	High intake rate.	Erodible; irregular slopes.	Highly unstable; erodible.
Moderate: slope.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Fair: low strength.	Moderate: slope.	Slope	Slope	Slope.
Severe: poorly drained; high shrink-swell potential; hazard of flooding.	Slight	Moderate: fair slope stability; fair resistance to piping and erosion.	Poor: high shrink-swell potential.	Poor: clay	Very low intake rate; hazard of outside water.	Hazard of flooding.	Hazard of flooding.
Moderate: low strength; slope.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Moderate permeability.	Erodible	Erodible.
Moderate: slope.	Severe: seepage.	Severe: 5 to 8 inches of borrow material.	Fair: low strength.	Poor: 5 to 8 inches of loam.	Bedrock at depth of 5 to 8 inches; slope.	Bedrock at depth of 5 to 8 inches; slope.	Bedrock at depth of 5 to 8 inches; slope.
Moderate: rippable bedrock at depth of 12 to 18 inches.	Severe: bedrock at depth of 12 to 18 inches.	Severe: 12 to 18 inches of borrow material.	Severe: bedrock at depth of 12 to 18 inches.	Fair: slope	Bedrock at depth of 12 to 18 inches; slope.	Bedrock at depth of 12 to 18 inches; slope.	Bedrock at depth of 12 to 18 inches; slope.
Severe: high shrink-swell potential.	Slight	Moderate: fair slope stability.	Poor: high shrink-swell potential.	Poor: 4 to 7 inches of clay loam.	All features favorable.	All features favorable.	All features favorable.
Moderate: low strength.	Moderate: moderate permeability.	Moderate: fair slope stability; poor resistance to piping and erosion.	Fair: low strength.	Fair: clay loam.	All features favorable.	All features favorable.	All features favorable.
Severe: hazard of flooding.	Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Poor: poorly drained.	Poor: poorly drained.	Hazard of flooding.	Hazard of flooding.	Hazard of flooding.
Moderate: slope.	Severe: moderately rapid permeability.	Moderate: poor resistance to piping and erosion.	Good	Poor: coarse fragments.	Low available water capacity; coarse fragments.	Slope; coarse fragments.	Slope; coarse fragments.

TABLE 6.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The as indicated in the first

Soil series and map symbols	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfills
Tivoli: Tv	Moderate: slope.	Severe: rapid permeability.	Severe: fine sand.	Moderate: slope.	Severe: rapid permeability; fine sand.
Urban land. Mapped only with Dallam, Obaro, or Veal soils. No interpretations made; properties too variable to be rated.					
*Veal: VeB, VeC, VuC. Urban land part of VuC is too variable to be rated.	Slight	Severe: seepage.	Slight	Slight	Slight
Veal part of BVE and MVE	Moderate: slope.	Severe: seepage.	Moderate: slope.	Moderate: slope.	Slight
Yahola: Ya	Severe: hazard of flooding.	Severe: hazard of flooding; moderately rapid permeability.	Severe: hazard of flooding.	Severe: hazard of flooding.	Severe: hazard of flooding.

Formation and Classification of Soils

In the following pages, the five major factors of soil formation and the classification of soils are discussed. Table 7 shows the classification of series into higher categories.

Formation of Soils

The factors that determine the kind of soil that forms at any given point are the climate under which the soil material accumulated and weathered; the living organisms on and in the soil; the composition of the parent material; the relief, or lay of the land; and the length of time that the forces of soil development have acted on the soil material. The relative importance of each factor differs from place to place, and each modifies the effect of the other four. In some places, one factor may dominate in the formation of a soil.

Climate and living organisms, chiefly vegetation, are the active forces of soil formation. They alter the accumulated soil material and bring about the development of genetically related horizons. Relief, mainly by its influence on temperature and runoff, modifies the effect of climate and vegetation. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. Usually a long time is required for the development of distinct horizons.

Climate

Hutchinson County has a dry steppe type of climate. The humidity and rainfall are low in winter and summer. The low rainfall retards soil formation. Although the climate is uniform throughout the county, its effect is modified locally by runoff and slope.

Living organisms

Plants, animals, insects, bacteria, and fungi are important in the formation of soils. These living organisms cause an increase in content of organic matter and supply of nitrogen, an increase or loss of other plant nutrients, and changes in structure and porosity.

Plants have influenced the soils that have a high to medium content of organic matter and a dark-colored surface layer. Tivoli and Likes soils are exceptions, and they are low in content of organic matter.

properties of the soils—Continued

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other series column of this table]

Degree and kind of limitation for—Continued			Suitability as a source of—		Soil features affecting—		
Local roads and streets	Pond reservoir areas	Pond embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Waterways
Moderate: slope.	Severe: rapid permeability.	Severe: poor stability; poor resistance to piping and erosion.	Good	Poor: fine sand.	Slope; rapid permeability; erodible.	Erodible; slope.	Erodible; slope.
Moderate: low strength.	Severe: seepage.	Moderate: poor resistance to piping and erosion.	Fair: low strength.	Fair: 5 to 7 inches of fine sandy loam.	Erodible	Erodible	Erodible.
Moderate: low strength; slope.	Severe: seepage.	Moderate: poor resistance to piping and erosion.	Fair: low strength.	Fair: 5 to 7 inches of fine sandy loam.	Erodible; slope.	Erodible; slope.	Erodible; slope.
Severe: hazard of flooding.	Severe: moderately rapid permeability.	Moderate: fair to medium compressibility; poor resistance to piping and erosion.	Fair: low strength.	Good	Hazard of flooding.	Hazard of flooding.	Hazard of flooding.

Parent material

The parent material is the unconsolidated mass from which soils are formed. It determines the chemical and mineralogical composition of the soil. In Hutchinson County the parent material is of mixed origin and is mostly calcareous to alkaline, unconsolidated, loamy and sandy material.

Sherm, Sunray, and Gruver soils formed in loamy and clayey eolian parent material. They generally are more fully developed than soils such as Likes and Tivoli soils that formed in sandy parent material.

Most parent materials of the soils in Hutchinson County contain some lime. Finer sized particles also contain more weatherable minerals that are available to plants and animals during the process of soil formation. Particle size also influences the rate at which water enters and percolates through the soil. It also influences the amount that is held by the soil material. Water filters rapidly through sand, but it filters slowly through clay because much of it is retained.

Relief

Relief affects the formation of soils by influencing drainage and runoff, rate of erosion, plant cover, and exposure to sun and wind. Moisture affects the kind and amount of plant and animal life on and in the soil. The areas that have steeper slopes, such as Potter soils, absorb less moisture and have less well-formed profiles than soils, such as Sherm clay loam, that are nearly level to gently sloping. In the steeper areas, such as Mobeetie soils, geological or continuous erosion retards the process of soil formation. The soils on floods plains, such as Humbarger soils, receive additional water and sediment from other soils. They also have a thick, dark-colored A horizon.

Time

Time is required for soils to form. The time required depends on the kind of parent material, the climate, the plant and animal life, and the relief.

Some soils change little in the passage of time because environmental factors have influenced the parent material. Dumas, Gruver, and Sherm soils have been in place long enough to have formed pronounced layers.

In some soils the climate, plant and animal life, and relief have only started altering the parent material.

TABLE 7.—*Classification of soil series*

Series	Family	Subgroup	Order
Berda [1]	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Burson	Loamy, mixed (calcareous), thermic, shallow	Ustic Torriorthents	Entisols.
Clairemont	Fine-silty, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Conlen [1]	Fine-loamy, carbonatic, mesic	Calciorthidic Paleustolls	Mollisols.
Dallam	Fine-loamy, mixed, mesic	Aridic Paleustalfs	Alfisols.
Dumas	Fine-loamy, mixed, mesic	Aridic Paleustolls	Mollisols.
Gruver	Fine, mixed, mesic	Aridic Paleustolls	Mollisols.
Humbarger	Fine-loamy, mixed, mesic	Cumulic Haplustolls	Mollisols.
Likes	Mixed, thermic	Typic Ustipsamments	Entisols.
Lincoln	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Mansker	Fine-loamy, carbonatic, thermic	Calciorthidic Paleustolls	Mollisols.
Mobeetie [1]	Coarse-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Ness [1]	Fine, montmorillonitic, mesic	Udic Pellusterts	Vertisols.
Obaro	Fine-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Potter [1]	Loamy, carbonatic, thermic, shallow	Ustollic Calciorthids	Aridisols.
Quinlan	Loamy, mixed, thermic, shallow	Typic Ustochrepts	Inceptisols.
Sherm	Fine, mixed, mesic	Torrertic Paleustolls	Mollisols.
Sunray	Fine-loamy, mixed, mesic	Calciorthidic Paleustolls	Mollisols.
Sweetwater	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), thermic	Fluvaquentic Haplaquolls	Mollisols.
Tascosa [1]	Loamy-skeletal, mixed, mesic	Aridic Calciustolls	Mollisols.
Tivoli	Mixed, thermic	Typic Ustipsamments	Entisols.
Veal	Fine-loamy, carbonatic, thermic	Aridic Ustochrepts	Inceptisols.
Yahola	Coarse-loamy, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.

[1] In this county, the following soils are taxadjuncts to the series for which they are named because they are outside the range described for the series.

Most Berda, Mobeetie, and Potter soils are in the thermic zone, but some Berda, Mobeetie, and Potter soils that have a temperature of less than 59° are outside the range described for their series.

Most Conlen, Ness, and Tascosa soils are in the mesic zone, but a few Conlen soils and some Ness and Tascosa soils that have a temperature of more than 59° are outside the range described for their series.

These factors are affecting the soil, but more time is needed for distinct horizons to form.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents (*2*).

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*3*, *6*). Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories (*4*). Beginning with the broadest, the categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the order. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of water-logging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Fluvent* (*Fluv*, meaning composed of recent alluvium, and *ent*, from Entisol).

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown

colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Ustifluvent* (*Ust*, meaning dry for long periods, *fluv* for composed of recent alluvium, and *ent*, from Entisols).

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great groups, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Ustifluvents (a typical Ustifluvent).

FAMILY. Soil families are separated within subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiate as shown in table 7. An example is the sandy, mixed, thermic family of Typic Ustifluvents.

General Nature of the County

Plains Indians were about the only inhabitants of this county until buffalo hunters arrived in the 1860's. Cattlemen soon followed in the 1880's and 1890's. By 1900, much of the county had been settled, and in 1901, Hutchinson County was organized. Since 1923, oil has been produced in large amounts. The feeding of cattle in feedlots is increasing. In the 1960's, Lake Meredith was built. The lake is 27 miles long, and it furnishes water for the 11 cities that are members of the Canadian River Municipal Water Authority.

Climate [4]

The climate in Hutchinson County is dry and continental and is characterized by a wide range in annual temperature. It is typical of steppes; the humidity is low in summer and winter. In winter most days are sunny and mild; the nights are clear and cold; and freezing temperatures occur almost every night. The Borger area is subjected to sharp drops in temperature in winter when cold polar air masses sweep out of Canada across the level plains at a speed of 30 to 40 miles an hour. Spring has the greatest variety of weather, and at times, trees and shrubs that have bloomed too early are nipped by a late freeze. In summer, afternoon temperatures are sometimes hot, but most nights are pleasantly cool. Cloudiness and precipitation can cause significant cooling during the day. In fall, the days are frequently mild and sunny, and the nights clear and cool, but the wind is not so strong as in spring. Evaporation-type air conditioners operate efficiently in this relatively dry climate.

Table 8 gives temperature and precipitation data. These data are based on records kept at Borger.

The mean total annual precipitation is 20.70 inches, but the amount varies widely from month to month and from year to year. At Borger a total of 32.71 inches fell in 1950, the wettest year, but only 10.21 inches fell in 1970, the driest year. In an average year about 80 percent of the total precipitation falls in May through October, the warm season. In an exceptionally wet month or year, a significant part of the total rainfall is lost through runoff. Warm season rainfall is commonly the result of thunderstorms. Rainfall begins decreasing early in fall but decreases more sharply in November. In winter, which is a dry season, precipitation most often falls in the form of light snow that piles up in drifts. As a result of the drifting the water from melting snow is not uniformly distributed.

Thunderstorms rarely occur in winter, but they are frequent late in spring and in summer. In an average year, at Borger, thunderstorms occur on 50 days.

In winter cold spells rarely last longer than 48 hours before sunshine and warmer southwesterly winds return. At Borger, the lowest temperature recorded since 1949 was 12° below zero in February 1951, and the highest was 107° in June 1968. Warm and cold spells follow each other in rapid succession throughout March and April. Fall temperatures are moderate.

At Borger the freeze-free period averages 187 days. The average date when the last temperature of 32° or below occurs in spring is April 20 and the first in fall is October 24.

The prevailing winds are southwesterly in November through April and southerly in May through October. Occasionally late in winter and in spring, strong southwesterly to northwesterly winds cause soil blowing.

The mean relative humidity at noon is estimated at 49 percent in January, 39 percent in April, 43 percent in July, and 40 percent in October. Borger receives about 68 percent of the total possible sunshine in winter and about 76 percent in summer.

In an average year, 44 more inches of water (lake) evaporates than is received as precipitation.

[4] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

Literature Cited

(1) American Association of State Highway and Transportation Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.
(2) Baldwin, Mark, Kellog, Charles E., and Thorp, James. 1938. Soil classification. U.S. Dep. Agric. Yearb., pp. 979–1001, illus.
(3) Simonson, Roy W. 1962. Soil classification in the United States. Science 137: 1027–1034.
(4) Thorp, James, and Smith, Guy D. 1949. Higher categories of soil classification: order, suborder, and great soil groups. Soil Sci. 67: 117–126.
(5) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Suppl. issued May 1962]

TABLE 8.—*Temperature*

[Data given is for the period 1949–1969. The elevation

Month	Temperature[1]				Precipitation			
	Mean daily maximum	Mean monthly highest maximum	Mean daily minimum	Mean monthly lowest maximum	Mean total[1]	Probability of receiving—		
						0 or trace	0.5 inch or more	1.0 inch or more
	°F	°F	°F	°F	*Inches*	*Percent*	*Percent*	*Percent*
January	53.3	74.0	24.8	3.9	0.45	10	40	20
February	56.5	76.8	28.2	9.8	.75	5	45	20
March	63.8	83.7	33.3	14.4	.80	10	56	30
April	74.1	90.6	44.0	28.8	1.24	1	85	60
May	81.9	95.5	53.5	39.7	3.45	<1	96	90
June	89.8	100.2	62.5	51.0	3.43	<1	90	80
July	92.8	100.7	67.0	59.8	4.05	<1	88	70
August	91.6	100.5	65.5	56.4	2.55	<1	91	80
September	84.8	95.6	58.0	44.9	1.58	5	80	60
October	75.8	91.3	47.3	32.6	1.26	6	70	70
November	62.5	79.1	34.3	17.1	.51	18	38	22
December	53.9	73.2	27.2	9.0	.63	8	43	25
Year	73.4	88.4	45.5	30.6	20.70	-------	--------	--------

[1]Average length of record is 21 years.
[2]Average length of record is 14 years.

(6) ——— 1960. Soil classification, a comprehensive system, 7th approximation. 265 pp., illus. [Suppl. issued March 1967, Sept. 1968, and Apr. 1969]
(7) United States Department of Defense. 1968. Unified soil classification system for roads, airfields, embankments and foundations. MIL-STD-619B, 30 pp., illus.

Glossary

ABC soil. A soil that has a complete profile, including an A, B, and C horizon.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity. The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

and precipitation data

is 3,140 feet. The symbol < means less than]

Precipitation										
Probability of receiving—Continued					Mean number[2] of days that have—			Snow, sleet		
2.0 inches or more	3.0 inches or more	4.0 inches or more	5.0 inches or more	6.0 inches or more	0.1 inch or more	0.5 inch or more	1.0 inch or more	Mean total[1]	Maximum monthly[1]	Greatest depth[2]
Percent	*Percent*	*Percent*	*Percent*	*Percent*				*Inches*	*Inches*	*Inches*
5	1	<1	<1	<1	2	(3)	0	3.8	12.7	7
3	<1	<1	<1	<1	3	1	(3)	4.9	26.0	24
10	4	1	<1	<1	2	1	(3)	3.2	19.5	6
25	8	4	<1	<1	2	1	(3)	.2	2.0	(4)
68	48	30	20	10	6	2	1	0	0	0
50	30	20	10	10	6	3	1	0	0	0
49	30	18	11	6	6	3	1	0	0	0
51	30	16	10	5	5	2	1	0	0	0
30	20	10	5	4	3	1	(3)	0	0	0
30	20	10	5	4	3	1	(3)	(4)	(4)	0
6	2	1	<1	<1	2	(3)	(3)	2.0	10.3	4
8	2	1	<1	<1	2	(3)	(3)	3.1	7.9	5
--------	--------	--------	--------	--------	42	15	4	17.2	26.0	24

[3]Less than one-half day.
[4]Trace, an amount too small to measure.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Decreaser. Any of the climax range plants most heavily grazed. Because they are the most palatable, they are first to be destroyed by overgrazing.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Increasers. Species in the climax vegetation that increase in relative amount as the more desirable plants are reduced by close grazing; increasers commonly are shorter than decreasers, and some are less palatable to livestock.

Invaders. On range, plants that come in and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface. (Most weeds are "invaders").

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is appied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Currugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range condition. The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are *—excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or climax vegetation on the site, as compared to what ought to grow on it if management were good.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind of climax vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Computer-Adapted Terms

Area reclaim. Borrow areas are difficult to reclaim, and revegetation and erosion control on these areas are extremely difficult.

Complex slope. Short and irregular slopes. Planning and construction of terraces, diversions, and other water-control measures are difficult.

Compressible. The soil is relatively soft and decreases excessively in volume when a load is applied.

Corrosive. The soil has high potential for causing uncoated steel to corrode or concrete to deteriorate.

Cutbanks cave. Walls of cuts are not stable. The soil sloughs easily.

Depth to rock. Bedrock is so near the surface that it affects specified use of the soil.

Excess alkali. Exchangeable sodium imparts poor physical properties that restrict the growth of plants.

Excess fines. The soil contains too much silt and clay for use as gravel or sand in construction.

Excess lime. The amount of carbonates in the soil is so high that it restricts the growth of some plants.

Excess salt. The amount of soluble salt in the soil is so high that it restricts the growth of most plants.

Fast intake. Water infiltrates rapidly into the soil.

Favorable. Features of the soil are favorable for the intended use.

Frost action. Freezing and thawing may damage structures.

Large stones. Rock fragments 10 inches or more across affect the specified use.

Low strength. The soil has inadequate strength to support loads.

Percs slowly. Water moves through the soil slowly, affecting the specified use.

Permafrost. The soil contains frozen layers throughout the year.

Piping. The soil is susceptible to the formation of tunnels or pipelike cavities by moving water.

Pitting. The soil is susceptible to the formation of pits caused by the melting of ground ice when the plant cover is removed.

Poor outlets. Surface or subsurface drainage outlets are difficult or expensive to install.

Rooting depth. A layer that greatly restricts the downward rooting of plants occurs at a shallow depth.

Seepage. Water moves through the soil so quickly that it affects the specified use.

Shrink-swell. The soil expands on wetting and shrinks on drying, which may cause damage to roads, dams, building foundations, or other structures.

Slow intake. Water infiltrates slowly into the soil.

Slow refill. Ponds fill slowly because the permeability of the soil is restricted.

Small stones. Rock fragments that are less than 10 inches across may affect the specified use.

Thin layer. Suitable soil material is not thick enough for use as borrow material or topsoil.

Unstable fill. Banks of fill are likely to cave in or slough.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1976—219-204/2

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit or range site, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 5.
Predicted yields, table 2, page 27.
Wildlife, table 3, page 32.
Recreational development, table 4, page 35.
Engineering uses of the soils, table 5, page 38, and table 6, page 42.

Map symbol	Mapping unit	Page	Capability unit Dryland	Capability unit Irrigated	Range site
			Symbol	Symbol	Name
BeB	Berda loam, 1 to 3 percent slopes	6	IIIe-4	IIIe-2	Hardland Slopes
BeC	Berda loam, 3 to 5 percent slopes	6	IVe-4	IVe-2	Hardland Slopes
BPF	Berda-Potter-Caliche outcrop association, steep	6	VIIs-1	-----	Rough Breaks
BSD	Berda and Mansker soils, 5 to 8 percent slopes	7	VIe-1	-----	Hardland Slopes
BVE	Berda and Veal soils, 3 to 15 percent slopes	7	VIe-1	-----	Hardland Slopes
BxF	Burson stony loam, steep	7	VIIs-1	-----	Rough Breaks
Ca	Clairemont silt loam	8	IIw-1	IIw-1	Loamy Bottomland
CnA	Conlen loam, 0 to 1 percent slopes	9	IVe-2	IIIe-4	Hardland Slopes
CnB	Conlen loam, 1 to 3 percent slopes	9	IVe-2	IIIe-4	Hardland Slopes
CnC	Conlen loam, 3 to 5 percent slopes	9	IVe-4	IVe-2	Hardland Slopes
DaA	Dallam fine sandy loam, 0 to 1 percent slopes	10	IIIe-3	IIe-2	Sandy Loam
DaB	Dallam fine sandy loam, 1 to 3 percent slopes	10	IIIe-3	IIIe-3	Sandy Loam
DaC	Dallam fine sandy loam, 3 to 5 percent slopes	10	IVe-3	IVe-1	Sandy Loam
DrB	Dallam-Urban land complex, 0 to 3 percent slopes	11	-----	-----	----------
DsA	Dumas loam, 0 to 1 percent slopes	11	IIIe-6	IIe-1	Clay Loam
DsB	Dumas loam, 1 to 3 percent slopes	11	IIIe-2	IIIe-2	Clay Loam
DuA	Dumas clay loam, 0 to 1 percent slopes	12	IIIe-6	IIe-1	Clay Loam
GrA	Gruver clay loam, 0 to 1 percent slopes	12	IIIe-6	IIe-1	Clay Loam
GrB	Gruver clay loam, 1 to 3 percent slopes	12	IIIe-2	IIIe-2	Clay Loam
Hm	Humbarger clay loam	13	IIe-1	IIe-1	Valley
Hu	Humbarger clay loam, channeled	13	Vw-1	-----	Valley
LkC	Likes loamy fine sand, 1 to 6 percent slopes	14	VIe-1	-----	Sandy
Ln	Lincoln soils	14	Vw-1	-----	Sandy Bottomland
MbB	Mobeetie fine sandy loam, 1 to 3 percent slopes	16	IVe-1	IIIe-3	Mixedland Slopes
MbC	Mobeetie fine sandy loam, 3 to 5 percent slopes	16	IVe-3	IVe-1	Mixedland Slopes
MbD	Mobeetie fine sandy loam, 5 to 12 percent slopes	16	VIe-2	-----	Mixedland Slopes
MVE	Mobeetie and Veal soils, 5 to 20 percent slopes	16	VIe-2	-----	Mixedland Slopes
Ne	Ness clay	17	1/VIw-1	-----	(2/).
OaB	Obaro loam, 1 to 3 percent slopes	17	IIIe-4	IIIe-2	Mixedland
OaC	Obaro loam, 3 to 5 percent slopes	18	IVe-3	IVe-1	Mixedland
ObD	Obaro-Urban land complex, 3 to 12 percent slopes	18	-----	-----	----------
OQE	Obaro and Quinlan soils, rolling	18	VIe-1	-----	Mixedland
PtE	Potter soils, 5 to 20 percent slopes	19	VIIs-1	-----	Very Shallow
ShA	Sherm clay loam, 0 to 1 percent slopes	19	IIIe-5	IIs-1	Clay Loam
ShB	Sherm clay loam, 1 to 3 percent slopes	20	IIIe-1	IIIe-1	Clay Loam
SuA	Sunray clay loam, 0 to 1 percent slopes	20	IIIe-6	IIe-1	Hardland Slopes
SuB	Sunray clay loam, 1 to 3 percent slopes	21	IIIe-2	IIIe-2	Hardland Slopes
Sw	Sweetwater soils	21	Vw-2	-----	Loamy Bottomland
TaE	Tascosa gravelly loam, 3 to 20 percent slopes	22	VIs-1	-----	Gravelly
Tv	Tivoli fine sand	22	VIIe-1	-----	Deep Sand
VeB	Veal fine sandy loam, 1 to 3 percent slopes	23	IVe-2	IIIe-4	Mixedland Slopes
VeC	Veal fine sandy loam, 3 to 5 percent slopes	24	IVe-4	IVe-2	Mixedland Slopes
VuC	Veal-Urban land complex, 1 to 5 percent slopes	24	-----	-----	----------
Ya	Yahola fine sandy loam	24	IIIe-3	IIe-2	Loamy Bottomland

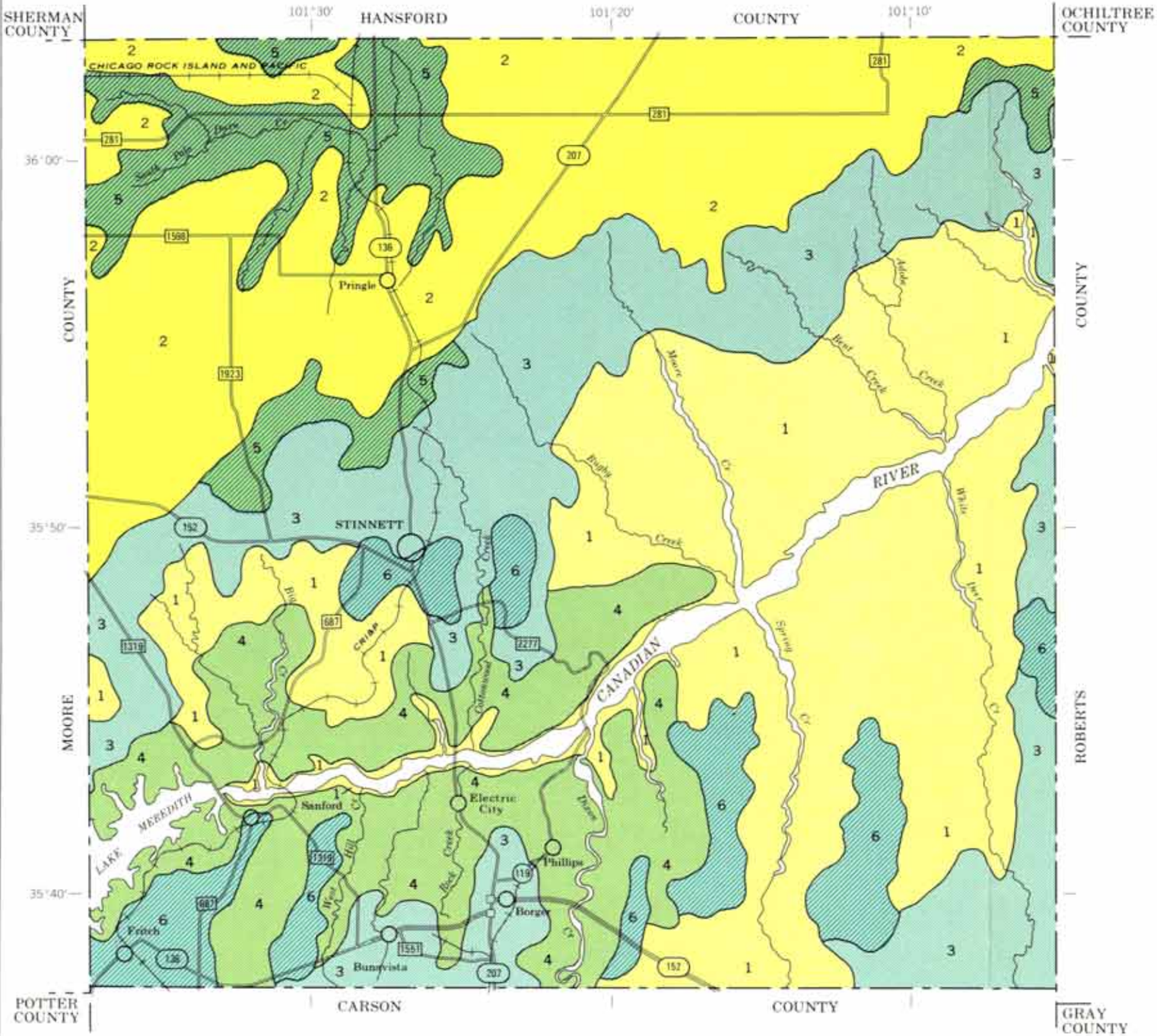
1/ IVs-1 if drained.

2/ Included in adjoining range site.

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.



SOIL ASSOCIATIONS *

1. LIKES-TIVOLI-LINCOLN association: Nearly level to sloping and rolling, noncalcareous or calcareous sandy soils that are moderately rapidly permeable or rapidly permeable
2. SHERM-GRUVER association: Nearly level to gently sloping, noncalcareous loamy soils that are very slowly permeable to moderately slowly permeable
3. MOBEETIE-BERDA-VEAL association: Gently sloping to steep, calcareous loamy soils that are moderately rapidly permeable to moderately permeable
4. TASCOSA-BURSON association: Gently sloping to steep, calcareous loamy to gravelly soils that are moderately permeable
5. CONLEN-SUNRAY-HUMBARGER association: Nearly level to gently sloping, calcareous loamy soils that are moderately permeable
6. DALLAM-DUMAS association: Nearly level to gently sloping, noncalcareous loamy soils that are moderately permeable

*The texture stated is that of the surface layer of the major soils in the association.

Compiled 1974

N

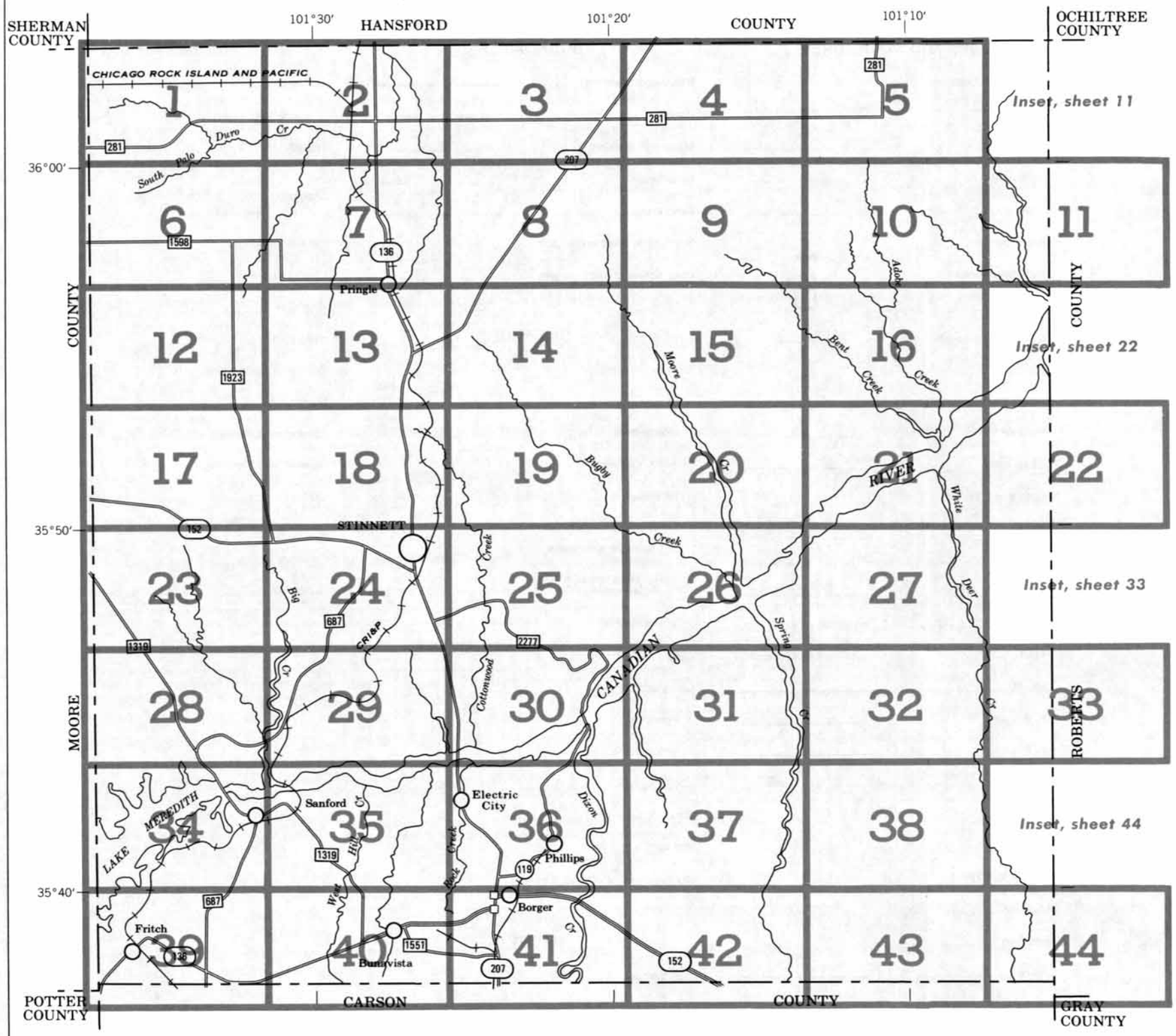
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

HUTCHINSON COUNTY, TEXAS

Scale 1:253,440
1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



N

INDEX TO MAP SHEETS

HUTCHINSON COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first letter, always a capital, is the initial one of the soil name. The second letter is lowercase if the mapping is of medium intensity; if of low intensity, the second letter is a capital. The third letter, always a capital, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for soils that have a considerable range of slope.

The symbol (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in some places, but the degree of erosion cannot be estimated reliably.

SYMBOL	NAME
BeB	Berda loam, 1 to 3 percent slopes
BeC	Berda loam, 3 to 5 percent slopes
BPF	Berda-Potter-Caliche outcrop association, steep 1/
BSD	Berda and Mansker soils, 5 to 8 percent slopes 1/
BVE	Berda and Veal soils, 3 to 15 percent slopes 1/
BxF	Burson stony loam, steep
Ca	Clairemont silt loam
CnA	Conlen loam, 0 to 1 percent slopes
CnB	Conlen loam, 1 to 3 percent slopes
CnC	Conlen loam, 3 to 5 percent slopes
DaA	Dallam fine sandy loam, 0 to 1 percent slopes (W)
DaB	Dallam fine sandy loam, 1 to 3 percent slopes (W)
DaC	Dallam fine sandy loam, 3 to 5 percent slopes (W)
DrB	Dallam-Urban land complex, 0 to 3 percent slopes
DsA	Dumas loam, 0 to 1 percent slopes
DsB	Dumas loam, 1 to 3 percent slopes
DuA	Dumas clay loam, 0 to 1 percent slopes
GrA	Gruver clay loam, 0 to 1 percent slopes
GrB	Gruver clay loam, 1 to 3 percent slopes
Hm	Humbarger clay loam
Hu	Humbarger clay loam, channeled
LkC	Likes loamy fine sand, 1 to 6 percent slopes (W)
Ln	Lincoln soils
MbB	Mobeetie fine sandy loam, 1 to 3 percent slopes (W)
MbC	Mobeetie fine sandy loam, 3 to 5 percent slopes (W)
MbD	Mobeetie fine sandy loam, 5 to 12 percent slopes
MVE	Mobeetie and Veal soils, 5 to 20 percent slopes 1/
Ne	Ness clay
OaB	Obaro loam, 1 to 3 percent slopes
OaC	Obaro loam, 3 to 5 percent slopes
ObD	Obaro-Urban land complex, 3 to 12 percent slopes
OQE	Obaro and Quinlan soils, rolling 1/
PtE	Potter soils, 5 to 20 percent slopes
ShA	Sherm clay loam, 0 to 1 percent slopes
ShB	Sherm clay loam, 1 to 3 percent slopes
SuA	Sunray clay loam, 0 to 1 percent slopes
SuB	Sunray clay loam, 1 to 3 percent slopes
Sw	Sweetwater soils
TaE	Tascosa gravelly loam, 3 to 20 percent slopes
Tv	Tivoli fine sand (W)
VeB	Veal fine sandy loam, 1 to 3 percent slopes
VeC	Veal fine sandy loam, 3 to 5 percent slopes
VuC	Veal-Urban land complex, 1 to 5 percent slopes
Ya	Yahola fine sandy loam (W)

1/Delineations of these soils generally are larger and those mapping units are more variable than other units in the survey area. Mapping has been controlled well enough, however, for the expected uses of the soils.

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State, farm or ranch

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit (G.P.)

Power line

Pipeline

Cemetery

Dams

Fence with terminal

Fence without terminal

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Well, irrigation

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Caliche pit (C.P.)
- Oil waste (O.W.)
- Borrow pit (B.P)

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 1

1 965 000 FEET

SHERMAN COUNTY

HANSFORD COUNTY

MOORE COUNTY

1 745 000 FEET

(Joins sheet 2)

(Joins sheet 6)

1 730 000 FEET

1 990 000 FEET

CHICAGO ROCK ISLAND AND PACIFIC

Palo Duro Creek

South

281

N

Scale 1:24000

2 Miles 10000 Feet

5000 0 5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately posthoned

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 2

2

N

2 020 000 FEET

HANSFORD COUNTY

2 Miles

10000 Feet

Scale 1:24000

1 5000 0

½ 1000 0

¼ 2000

½ 3000

¾ 4000

1 5000

745 000 FEET

730 000 FEET

1 995 000 FEET

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 7)

CHICAGO ROCK ISLAND AND PACIFIC

Morse Junction

Palo Duro Creek

South Palo Duro Creek

CHICAGO ROCK ISLAND AND PACIFIC

LIEB CEMETERY

281

136

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 3

2 025 000 FEET

745 000 FEET

HANSFORD COUNTY

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 8)

730 000 FEET

2 050 000 FEET

41 42 43 44 45
60 59 58 57 56
73 74 75 76 77
94 93 92 91 90

SuB SuA DuA ShA CnA CnB GrA GrB PtE ShB CnC BSD Ne

281 207

3

N

2 Miles

10000 Feet

Scale 1:24000

1 0 1/4 1/2 3/4 1 5000 0 1000 2000 3000 4000 5000

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 4

(4)

N

2 080 000 FEET

HANSFORD COUNTY

745 000 FEET

(Joins sheet 3)

(Joins sheet 5)

730 000 FEET

2 055 000 FEET

(Joins sheet 9)

Scale 1:24000

2 Miles 10000 Feet

1 5000

0 0

¼ 1000

2000

½ 3000

¾ 4000

1 5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

2 085 000 FEET

745 000 FEET

HANSFORD COUNTY

281

68 69 70 71 72 73

1 2 26 12 11 28 77 76 75

ShA Ne ShB GrA SuA SuB DuA CnB CnC BSD BPF PtE MVE Ln

(Joins sheet 4)

(Joins inset, sheet 11)

(Joins sheet 10)

730 000 FEET

2 110 000 FEET

5

N

Scale 1:24000

2 Miles 1

10000 Feet 5000 0

(Joins sheet 1)

N

2 Miles

10000 Feet

Scale 1:24000

1 0 ¼ ½ ¾ 0 1000 2000 3000 4000 5000

1 990 000 FEET

725 000 FEET

710 000 FEET

1 965 000 FEET

(Joins sheet 12)

(Joins sheet 7)

MOORE COUNTY

Duro Creek

Palo South

15 14 13 12 11 18 19 20 21 22 1 7 13

1598 1923

ShA ShB SuA SuB CnA CnB CnC GrA GrB Hm Hu BeB BeC BSD PtE BVE DuA Ne

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies

Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 7

1 995 000 FEET

725 000 FEET

(Joins sheet 2)

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 13)

2 020 000 FEET

710 000 FEET

7

N

Scale 1:24 000

2 Miles

10000 Feet

5000

0

1000

2000

3000

4000

5000

1/4

1/2

3/4

1

101 102 103 104 105 106

134 133 132 131 130 129

135 136 137 138 139 140

1 2 1 2 1 2

CHICAGO ROCK ISLAND AND PACIFIC

Pringle

1598

136

BSD

Ne

ShA ShB SuB SuA CnB CnC BVE PtE GrA GrB BeB BeC Hm DuA

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

8

N

(Joins sheet 3)

2 050 000 FEET

1 725 000 FEET

(Joins sheet 7)

(Joins sheet 9)

2 025 000 FEET

1 710 000 FEET

(Joins sheet 14)

2 Miles 10000 Feet

Scale 1:24000

1 5000 0 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

107 108 109 110 111

128 127 126 125 124

141 142 143 144 145

GrA CnA ShA Ne SuA SuB GrB ShB BVE CnC BSD BeC PtE

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 9

2 055 000 FEET

725 000 FEET

(Joins sheet 4)

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 15)

2 080 000 FEET

710 000 FEET

9

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

Moore Creek

Waters Ranch Canyon Creek

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 10

(10)

N

(Joins sheet 5)

2 110 000 FEET

2 Miles 10000 Feet

1 5000

Scale 1:24000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

¾ 4000

1 5000

(Joins sheet 9)

2 725 000 FEET

2 710 000 FEET

2 085 000 FEET

(Joins sheet 16)

(Joins sheet 11)

Ne ShA DuA CnB CnC BSD BPF MbD SuB SuA GrA PtE MVE LkC Ln MbB MbC

West Fork Johns Creek Adobe Creek Yeso

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

2 115 000 FEET

(Joins inset)

725 000 FEET

(Joins sheet 10)

MVE BPF LkC Ln MbB MbD Ya Sw MbC PtE Tv

Willow Creek

West Johns Fork Creek

ROBERTS COUNTY

(Joins inset, sheet 22)

2 120 000 FEET

710 000 FEET

HANSFORD COUNTY

OCHILTREE COUNTY

74

80

ShA ShB Ne GrA SuA SuB CnB CnC BSD BPF PtE MVE Ln

(Joins sheet 5)

(Joins upper left)

730 000 FEET

11

N

2 Miles

10000 Feet

Scale 1:24000

0 1000 2000 3000 4000 5000

(12)

N

(Joins sheet 6)

1 990 000 FEET

1 705 000 FEET

MOORE COUNTY

1 690 000 FEET

1 965 000 FEET

(Joins sheet 17)

(Joins sheet 13)

Scale 1:24000

2 Miles 10000 Feet

1 5000 0

¼ 1000

½ 2000

¾ 3000

1 4000 5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 13

1 995 000 FEET

705 000 FEET

(Joins sheet 7)

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 18)

2 020 000 FEET

690 000 FEET

13

N

Pringle

CHICAGO ROCK ISLAND AND PACIFIC

Scale 1:24000

2 Miles 1 0 1

10000 Feet 5000 0

5 000 4000 3000 2000 1000 0

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 14

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

1/4 1/2 3/4 1

1 000 2 000 3 000 4 000 5 000

(Joins sheet 8)

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 19)

2 050 000 FEET

705 000 FEET

690 000 FEET

2 025 000 FEET

Rocking D Ranch

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 15

15

N

2 055 000 FEET

705 000 FEET

(Joins sheet 9)

(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 20)

2 080 000 FEET

690 000 FEET

Scale 1:24000

2 Miles 1 0 10000 Feet

1 5000 0

¾ 4000 ½ 3000 ¼ 2000 0 1000

Moore Creek

Carson Creek

Bent Creek

BPF BSD CnB CnC DaB Ln LkC MbC MbD MVE PtE SuB Tv

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 16

16

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

(Joins sheet 10)

(Joins sheet 15)

(Joins inset, sheet 22)

(Joins sheet 21)

2 110 000 FEET

705 000 FEET

690 000 FEET

2 085 000 FEET

Adobe Creek

Bent Creek

Turkey Track Ranch

Adobe Walls Battlefield Monument

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 17

17

N

1 965 000 FEET

685 000 FEET

(Joins sheet 12)

(Joins sheet 18)

(Joins sheet 23)

1 990 000 FEET

670 000 FEET

COUNTY

MOORE

1923

152

2 Miles

1

10000 Feet

5000

Scale 1:24000

0 1 000 2000 3000 4000 5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

(18)

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

¼ ½ ¾ 1

1000 2000 3000 4000 5000

(Joins sheet 13)

(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 24)

2 020 000 FEET

685 000 FEET

670 000 FEET

1 995 000 FEET

PACIFIC

AND

ROCK ISLAND

CHICAGO

Supreme Camp

Big Creek

1973

136 207

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

2 025 000 FEET

685 000 FEET

(Joins sheet 14)

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 25)

6 710 000 FEET

2 050 000 FEET

19

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

1 ¼ ½ ¾ 1

5000 4000 3000 2000 1000 0

Britain Ranch

Signal Hill

Bugby Creek

Cottonwood Creek

Smokehouse Creek

Hm Creek

Ln Creek

BPF BSD BVE BeC BeB CnC CnB SuB MbD MbC VeB VeC PtE MVE DaB Hm Ln Tv LkC TaE

(Joins sheet 15)

N

2 Miles

10000 Feet

Scale 1:24000

1 5000

(Joins sheet 19)

2 080 000 FEET

685 000 FEET

(Joins sheet 21)

670 000 FEET

2 055 000 FEET

(Joins sheet 26)

Moore Creek

Carson Creek

Moore Creek

Creek

BPF LkC Tv Ln MVE MbC TaE OQE Sw

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

(21)

2 085 000 FEET

685 000 FEET

670 000 FEET

2 110 000 FEET

(Joins sheet 16)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 27)

N

2 Miles

10000 Feet

Scale 1:24000

1 0 1 000 2000 3000 4000 5000

Bent Creek

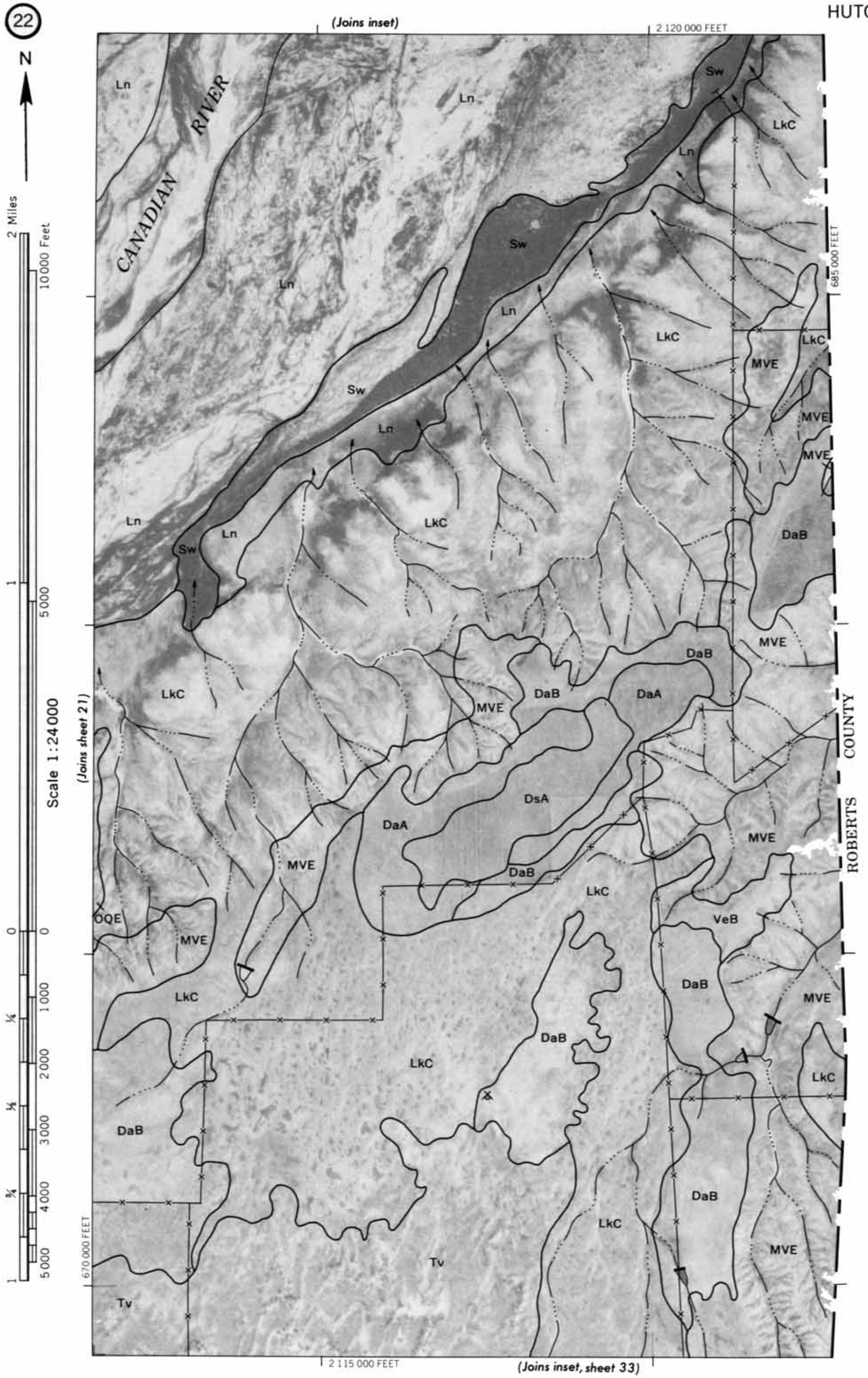
Adobe Creek

CANADIAN RIVER

Carson Creek

White Deer Creek

LkC MVE Ln Sw Tv BPF MbD OQE TaE BxF DaB Ca



This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 965 000 FEET

665 000 FEET

(Joins sheet 17)

(Joins sheet 24)

(Joins sheet 28)

1 990 000 FEET

650 000 FEET

MOORE COUNTY

23

N

2 Miles

10000 Feet

Scale 1:24000

1 0 1 5000

¾ 0 ¾ 4000

½ 1000 ½ 3000

¼ 2000 ¼

0 1000

(Joins sheet 18)

(Joins sheet 23)

(Joins sheet 25)

(Joins sheet 29)

2 020 000 FEET

665 000 FEET

1 995 000 FEET

650 000 FEET

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

1 000 ¼

2 000 ½

3 000 ¾

4 000 1

5 000

STINNETT (county seat)

Creslenn Camp

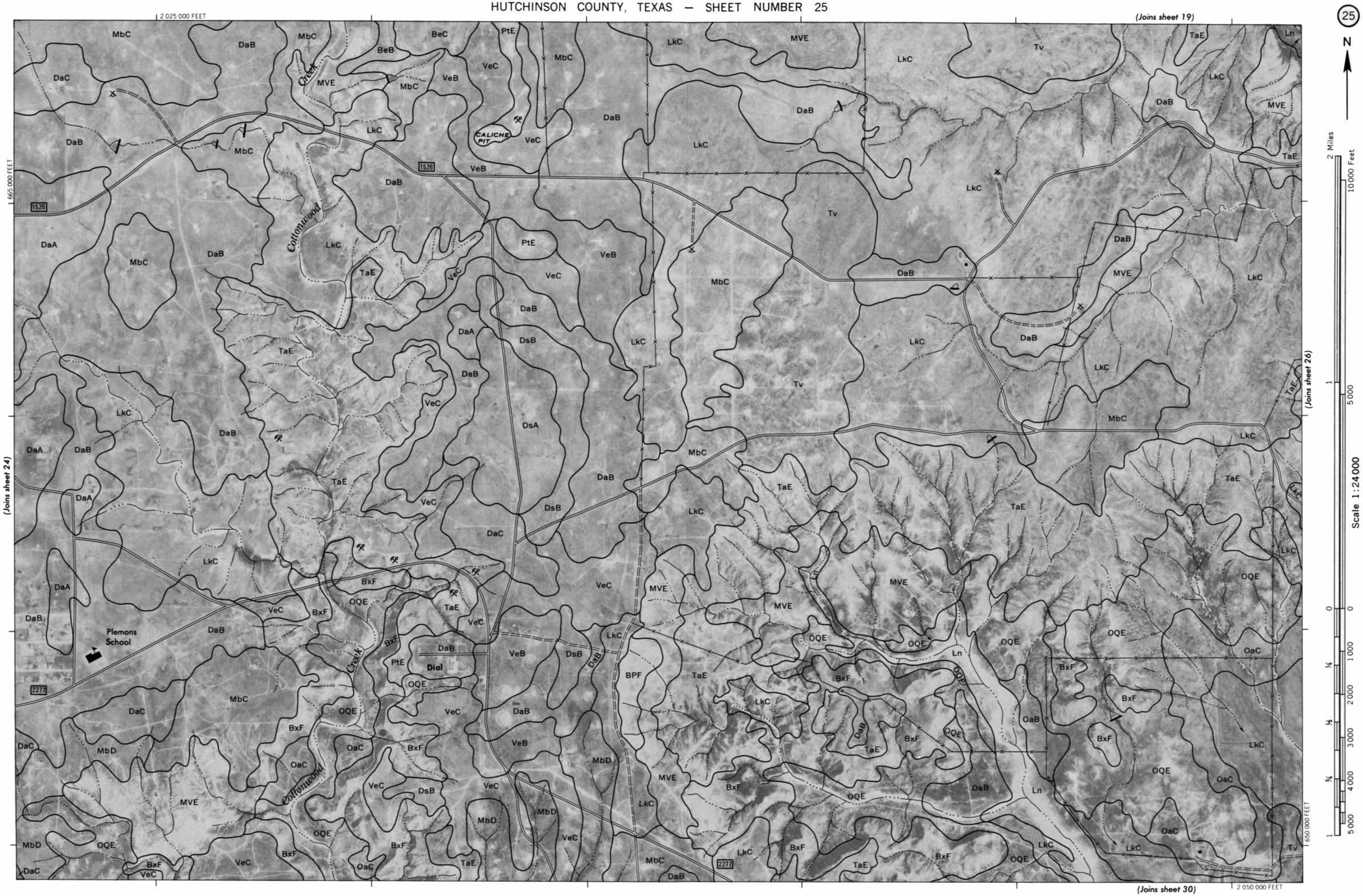
Big Creek

Ln

Tor Box Creek

CHICAGO ROCK ISLAND PACIFIC

DaA DaB DaC DsA DrB LkC MbC MbD MVE TaE Tv VeB VeC BVE BeC CnA CnB



This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

(26)

N

Scale 1:24000

2 Miles 1

10000 Feet 0

5000 0

1 000 1/4

2 000 1/2

3 000 3/4

4 000 1

5 000 1

(Joins sheet 20)

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 31)

2 080 000 FEET

665 000 FEET

2 055 000 FEET

650 000 FEET

Bugby Creek

Moore Creek

CANADIAN RIVER

Spring Creek

Plemons

Ln Tv Sw TaE LkC MVE OQE OaB OaC BxF DaB VeB MbC MbD

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 27

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 085 000 FEET

665 000 FEET

(Joins sheet 21)

(Joins sheet 26)

(Joins inset, sheet 33)

(Joins sheet 32)

2 110 000 FEET

650 000 FEET

CANADIAN RIVER

White Deer Creek

LkC MVE Tv Sw Ln Ya TaE DaA DaB DsA DsB VeB VeC BxF

27

N

2 Miles

1

10000 Feet

5000

Scale 1:24000

0 1000 2000 3000 4000 5000

28

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 28

N

2 Miles

10000 Feet

Scale 1:24000

1 990 000 FEET

645 000 FEET

630 000 FEET

1 965 000 FEET

(Joins sheet 23)

(Joins sheet 29)

(Joins sheet 34)

MOORE COUNTY

Bugbee Creek

RECREATION AREA

BUGBEE CANYON RECREATION AREA

BORROW PIT

1319

687

BeC VeB BVE MVE DaB LkC DaA MbC DsB VeC BSD DaC TaE DsA CnB MbD Tv BxF OQE OaC Ln Ca

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 29

(Joins sheet 24)

1 995 000 FEET

645 000 FEET

(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 35)

630 000 FEET

2 020 000 FEET

29

N

Scale 1:24000

2 Miles 1 0 10000 Feet

1 5000 0

¾ 4000 1000

½ 3000 2000

¼ 0 1000

1 5000 0

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

Big Creek

Box Creek

CANADIAN RIVER

CANADIAN RIVER

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 30

(30)

N

(Joins sheet 25)

2 050 000 FEET

645 000 FEET

(Joins sheet 29)

(Joins sheet 31)

630 000 FEET

2 025 000 FEET

(Joins sheet 36)

Scale 1:24000

2 Miles 1

10000 Feet 5000

1 0

¼ ¼

¾ ¾

5000 4000 3000 2000 1000 0

Cottonwood Creek

Stekoll Camp

CANADIAN RIVER

Dixon Creek

OIL WASTE

G.P.

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 31

(Joins sheet 26)

2 055 000 FEET

645 000 FEET

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 37)

630 000 FEET

2 080 000 FEET

31

N

2 Miles

10000 Feet

Scale 1:24000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

1 000 0 1 000 2 000 3 000 4 000 5 000

(Joins sheet 27)

(Joins sheet 31)

(Joins sheet 33)

(Joins sheet 38)

2 110 000 FEET

645 000 FEET

630 000 FEET

2 085 000 FEET

2 115 000 FEET

(Joins inset)

645 000 FEET

(Joins sheet 32)

630 000 FEET

(Joins inset, sheet 44)

2 120 000 FEET

ROBERTS COUNTY

2 115 000 FEET

(Joins sheet 22)

665 000 FEET

(Joins sheet 27)

650 000 FEET

(Joins upper left)

2 120 000 FEET

Ya Ln Hu LkC Tv TaE MVE DaB MbD VeC Sw BPF

White Deer Creek

West Camp

33

N

2 Miles 1

10000 Feet 5000

Scale 1:24000

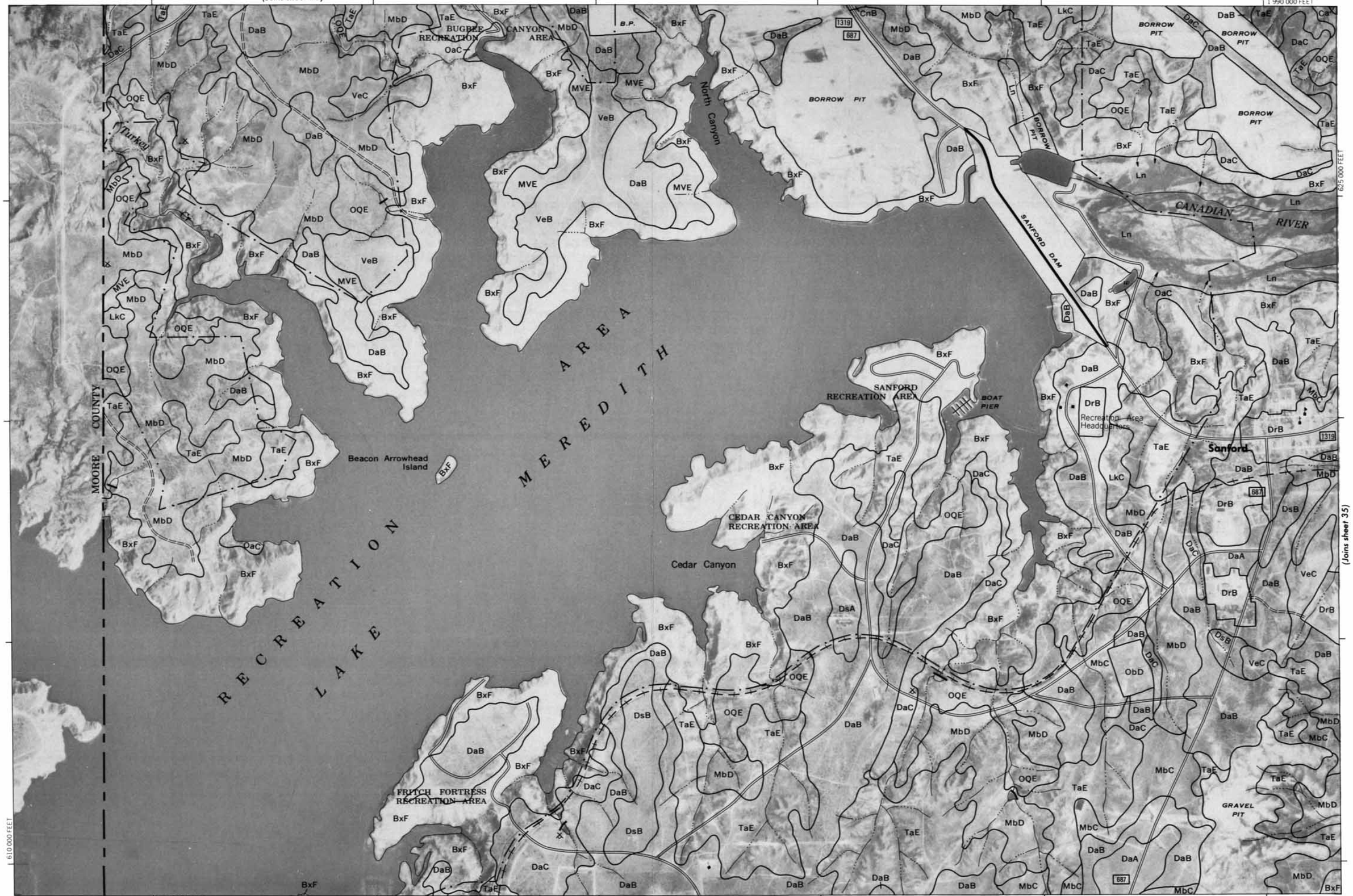
0 ¼ ½ ¾ 1

1000 2000 3000 4000 5000

(Joins sheet 28)

1 990 000 FEET

625 000 FEET



610 000 FEET

1 965 000 FEET

(Joins sheet 39)

(Joins sheet 35)

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

1 5000

¼ 1000

½ 2000

¾ 3000

¾ 4000

1 5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 995 000 FEET

625 000 FEET

(Joins sheet 29)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 40)

610 000 FEET

2 020 000 FEET

CANADIAN RIVER

Big Creek

Antelope Creek

West Creek

Hill

GRAVEL PIT

1319

1559

35

N

2 Miles

10000 Feet

5000

Scale 1:24000

1 0 1 000 2000 3000 4000 5000

N

2 Miles 1

10000 Feet 5000

Scale 1:24000

(Joins sheet 30)

(Joins sheet 35)

(Joins sheet 37)

(Joins sheet 41)

2 050 000 FEET

625 000 FEET

610 000 FEET

2 025 000 FEET

CANADIAN RIVER

Electric City

HUTCHINSON COUNTY AIRPORT

PHILLIPS PARK

PHILLIPS

BORGER

HIGHLAND PARK CEMETERY

Rock Creek

Pollon Creek

Panics Reservoir

Dixon Creek

SANTA FE

TOPEKA AND ATCHISON

OIL WASTE

Ca Ln LkC Tv OaB OaC OaE OaF OaG OaH OaI OaJ OaK OaL OaM OaN OaO OaP OaQ OaR OaS OaT OaU OaV OaW OaX OaY OaZ ObA ObB ObC ObD ObE ObF ObG ObH ObI ObJ ObK ObL ObM ObN ObO ObP ObQ ObR ObS ObT ObU ObV ObW ObX ObY ObZ OcA OcB OcC OcD OcE OcF OcG OcH OcI OcJ OcK OcL OcM OcN OcO OcP OcQ OcR OcS OcT OcU OcV OcW OcX OcY OcZ OdA OdB OdC OdD OdE OdF OdG OdH OdI OdJ OdK OdL OdM OdN OdO OdP OdQ OdR OdS OdT OdU OdV OdW OdX OdY OdZ OeA OeB OeC OeD OeE OeF OeG OeH OeI OeJ OeK OeL OeM OeN OeO OeP OeQ OeR OeS OeT OeU OeV OeW OeX OeY OeZ OfA OfB OfC OfD OfE OfF OfG OfH OfI OfJ OfK OfL OfM OfN OfO OfP OfQ OfR OfS OfT OfU OfV OfW OfX OfY OfZ OgA OgB OgC OgD OgE OgF OgG OgH OgI OgJ OgK OgL OgM OgN OgO OgP OgQ OgR OgS OgT OgU OgV OgW OgX OgY OgZ OhA OhB OhC OhD OhE OhF OhG OhH OhI OhJ OhK OhL OhM OhN OhO OhP OhQ OhR OhS OhT OhU OhV OhW OhX OhY OhZ OiA OiB OiC OiD OiE OiF OiG OiH OiI OiJ OiK OiL OiM OiN OiO OiP OiQ OiR OiS OiT OiU OiV OiW OiX OiY OiZ OjA OjB OjC OjD OjE OjF OjG OjH OjI OjJ OjK OjL OjM OjN OjO OjP OjQ OjR OjS OjT OjU OjV OjW OjX OjY OjZ OkA OkB OkC OkD OkE OkF OkG OkH OkI OkJ OkK OkL OkM OkN OkO OkP OkQ OkR OkS OkT OkU OkV OkW OkX OkY OkZ OlA OlB OlC OlD OlE OlF OlG OlH OlI OlJ OlK OlL OlM OlN OlO OlP OlQ OlR OlS OlT OlU OlV OlW OlX OlY OlZ OmA OmB OmC OmD OmE OmF OmG OmH OmI OmJ OmK OmL OmM OmN OmO OmP OmQ OmR OmS OmT OmU OmV OmW OmX OmY OmZ OnA OnB OnC OnD OnE OnF OnG OnH OnI OnJ OnK OnL OnM OnN OnO OnP OnQ OnR OnS OnT OnU OnV OnW OnX OnY OnZ OoA OoB OoC OoD OoE OoF OoG OoH OoI OoJ OoK OoL OoM OoN OoO OoP OoQ OoR OoS OoT OoU OoV OoW OoX OoY OoZ OpA OpB OpC OpD OpE OpF OpG OpH OpI OpJ OpK OpL OpM OpN OpO OpP OpQ OpR OpS OpT OpU OpV OpW OpX OpY OpZ OqA OqB OqC OqD OqE OqF OqG OqH OqI OqJ OqK OqL OqM OqN OqO OqP OqQ OqR OqS OqT OqU OqV OqW OqX OqY OqZ OrA OrB OrC OrD OrE OrF OrG OrH OrI OrJ OrK OrL OrM OrN OrO OrP OrQ OrR OrS OrT OrU OrV OrW OrX OrY OrZ OsA OsB OsC OsD OsE OsF OsG OsH OsI OsJ OsK OsL OsM OsN OsO OsP OsQ OsR OsS OsT OsU OsV OsW OsX OsY OsZ OtA OtB OtC OtD OtE OtF OtG OtH OtI OtJ OtK OtL OtM OtN OtO OtP OtQ OtR OtS OtT OtU OtV OtW OtX OtY OtZ OuA OuB OuC OuD OuE OuF OuG OuH OuI OuJ OuK OuL OuM OuN OuO OuP OuQ OuR OuS OuT OuU OuV OuW OuX OuY OuZ OvA OvB OvC OvD OvE OvF OvG OvH OvI OvJ OvK OvL OvM OvN OvO OvP OvQ OvR OvS OvT OvU OvV OvW OvX OvY OvZ OwA OwB OwC OwD OwE OwF OwG OwH OwI OwJ OwK OwL OwM OwN OwO OwP OwQ OwR OwS OwT OwU OwV OwW OwX OwY OwZ OxA OxB OxC OxD OxE OxF OxG OxH OxI OxJ OxK OxL OxM OxN OxO OxP OxQ OxR OxS OxT OxU OxV OxW OxX OxY OxZ OyA OyB OyC OyD OyE OyF OyG OyH OyI OyJ OyK OyL OyM OyN OyO OyP OyQ OyR OyS OyT OyU OyV OyW OyX OyY OyZ OzA OzB OzC OzD OzE OzF OzG OzH OzI OzJ OzK OzL OzM OzN OzO OzP OzQ OzR OzS OzT OzU OzV OzW OzX OzY OzZ BeB BxF DaB DaC DrB DsB MbC MbD MbE MbF MbG MbH MbI MbJ MbK MbL MbM MbN MbO MbP MbQ MbR MbS MbT MbU MbV MbW MbX MbY MbZ MeA MeB MeC MeD MeE MeF MeG MeH MeI MeJ MeK MeL MeM MeN MeO MeP MeQ MeR MeS MeT MeU MeV MeW MeX MeY MeZ MfA MfB MfC MfD MfE MfF MfG MfH MfI MfJ MfK MfL MfM MfN MfO MfP MfQ MfR MfS MfT MfU MfV MfW MfX MfY MfZ MgA MgB MgC MgD MgE MgF MgG MgH MgI MgJ MgK MgL MgM MgN MgO MgP MgQ MgR MgS MgT MgU MgV MgW MgX MgY MgZ MhA MhB MhC MhD MhE MhF MhG MhH MhI MhJ MhK MhL MhM MhN MhO MhP MhQ MhR MhS MhT MhU MhV MhW MhX MhY MhZ MiA MiB MiC MiD MiE MiF MiG MiH MiI MiJ MiK MiL MiM MiN MiO MiP MiQ MiR MiS MiT MiU MiV MiW MiX MiY MiZ MjA MjB MjC MjD MjE MjF MjG MjH MjI MjJ MjK MjL MjM MjN MjO MjP MjQ MjR MjS MjT MjU MjV MjW MjX MjY MjZ MkA MkB MkC MkD MkE MkF MkG MkH MkI MkJ MkK MkL MkM MkN MkO MkP MkQ MkR MkS MkT MkU MkV MkW MkX MkY MkZ MlA MlB MlC MlD MlE MlF MlG MlH MlI MlJ MlK MlL MlM MlN MlO MlP MlQ MlR MlS MlT MlU MlV MlW MlX MlY MlZ MmA MmB MmC MmD MmE MmF MmG MmH MmI MmJ MmK MmL MmM MmN MmO MmP MmQ MmR MmS MmT MmU MmV MmW MmX MmY MmZ MnA MnB MnC MnD MnE MnF MnG MnH MnI MnJ MnK MnL MnM MnN MnO MnP MnQ MnR MnS MnT MnU MnV MnW MnX MnY MnZ MoA MoB MoC MoD MoE MoF MoG MoH MoI MoJ MoK MoL MoM MoN MoO MoP MoQ MoR MoS MoT MoU MoV MoW MoX MoY MoZ MpA MpB MpC MpD MpE MpF MpG MpH MpI MpJ MpK MpL MpM MpN MpO MpP MpQ MpR MpS MpT MpU MpV MpW MpX MpY MpZ MqA MqB MqC MqD MqE MqF MqG MqH MqI MqJ MqK MqL MqM MqN MqO MqP MqQ MqR MqS MqT MqU MqV MqW MqX MqY MqZ MrA MrB MrC MrD MrE MrF MrG MrH MrI MrJ MrK MrL MrM MrN MrO MrP MrQ MrR MrS MrT MrU MrV MrW MrX MrY MrZ MsA MsB MsC MsD MsE MsF MsG MsH MsI MsJ MsK MsL MsM MsN MsO MsP MsQ MsR MsS MsT MsU MsV MsW MsX MsY MsZ MtA MtB MtC MtD MtE MtF MtG MtH MtI MtJ MtK MtL MtM MtN MtO MtP MtQ MtR MtS MtT MtU MtV MtW MtX MtY MtZ MuA MuB MuC MuD MuE MuF MuG MuH MuI MuJ MuK MuL MuM MuN MuO MuP MuQ MuR MuS MuT MuU MuV MuW MuX MuY MuZ MvA MvB MvC MvD MvE MvF MvG MvH MvI MvJ MvK MvL MvM MvN MvO MvP MvQ MvR MvS MvT MvU MvV MvW MvX MvY MvZ MwA MwB MwC MwD MwE MwF MwG MwH MwI MwJ MwK MwL MwM MwN MwO MwP MwQ MwR MwS MwT MwU MwV MwW MwX MwY MwZ MxA MxB MxC MxD MxE MxF MxG MxH MxI MxJ MxK MxL MxM MxN MxO MxP MxQ MxR MxS MxT MxU MxV MxW MxX MxY MxZ MyA MyB MyC MyD MyE MyF MyG MyH MyI MyJ MyK MyL MyM MyN MyO MyP MyQ MyR MyS MyT MyU MyV MyW MyX MyY MyZ MzA MzB MzC MzD MzE MzF MzG MzH MzI MzJ MzK MzL MzM MzN MzO MzP MzQ MzR MzS MzT MzU MzV MzW MzX MzY MzZ VeC VuC

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 37

2 055 000 FEET

(Joins sheet 31)

625 000 FEET

(Joins sheet 36)

(Joins sheet 38)

(Joins sheet 42)

2 080 000 FEET

610 000 FEET

37

N

Scale 1:24000

2 Miles

10000 Feet

5000

Jims Lake

Spring

Creek

Bear

GRAVEL PIT

280

The map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 38

N

(Joins sheet 32)

(Joins sheet 37)

(Joins sheet 43)

(Joins inset, sheet 44)

2 110 000 FEET

625 000 FEET

610 000 FEET

2 085 000 FEET

2 Miles 10000 Feet

Scale 1:24000

1 5000 0 0 1000 ¼ 2000 ½ 3000 ¾ 4000 1 5000

(Joins sheet 34)

(39)

N

1 965 000 FEET

605 000 FEET

LAKE MEREDITH RECREATION AREA

water

GRAVEL PIT

FRITCH

MOORE COUNTY

CARSON COUNTY

(Joins sheet 40)

590 000 FEET

1 990 000 FEET

Antelope Creek

Ln

OQE

BxF DaB DaA DaC DsA DsB DrB TaE MbC MbD MVE LkC Ne

136 687

2 Miles 1 0

10000 Feet 5000 0

Scale 1:24000

1 5000 0 1000 2000 3000 4000 5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

HUTCHINSON COUNTY, TEXAS — SHEET NUMBER 40

N

Scale 1:24 000

2 Miles

1

0

10000 Feet

5000

0

1000

2000

3000

4000

5000

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 025 000 FEET

605 000 FEET

(Joins sheet 36)

(Joins sheet 40)

(Joins sheet 42)

BORGER

FRANK PHILLIPS COLLEGE

CARSON COUNTY

590 000 FEET

2 050 000 FEET

N

2 Miles

10000 Feet

Scale 1:24 000

5000

0

1000

2000

3000

4000

5000

N

Scale 1:24000

2 Miles 1 0

10000 Feet 5000 0

1 ¼ ½ ¾ 1

1000 2000 3000 4000 5000

(Joins sheet 37)

(Joins sheet 41)

(Joins sheet 43)

2 080 000 FEET

605 000 FEET

590 000 FEET

2 055 000 FEET

Spring Creek School

Texroy

Bear Creek

Spring Creek

GRAVEL PIT

G.P.

BPF

CARSON COUNTY

BxF DaC DaB DsA DsB SuB BeC BeB TaE Ln LkC Tv VeB VeC MbC MbD MbB MVE OQE Hu Hm

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(43)

2 085 000 FEET

605 000 FEET

590 000 FEET

2 110 000 FEET

(Joins sheet 38)

(Joins sheet 42)

(Joins sheet 44)

CARSON COUNTY

1059

N

Scale 1:24000

2 Miles 10000 Feet

1 5000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

1¼ 5000

N

2 Miles

10000 Feet

Scale 1:24000

1 5000

(Joins inset)

2 120 000 FEET

605 000 FEET

(Joins sheet 43)

590 000 FEET

2 115 000 FEET

CARSON COUNTY

ROBERTS COUNTY

(Joins sheet 33)

625 000 FEET

(Joins sheet 38)

610 000 FEET

(Joins upper left)

Tv LkC MbB MbD Hm Ya MVE MbC Ln Hu DaB VeB VeC BeB BeC DsB DsA CnB CnA PtE Sw BPF BSD White Creek Deer

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.